CHAPTER 3: AFFECTED ENVIRONMENT

INTRODUCTION

This chapter provides a description of the existing biological, physical, and socioeconomic characteristics, including human uses that could be affected by implementing the action alternatives as described in Chapter 2, for this resource management plan (RMP). Information from broad-scale assessments were used to help set the context for the planning area. The information and direction for the Bureau of Land Management (BLM) resources has been further broken into fine-scale assessments and information where possible. The public and agency scoping process raised specific aspects of each resource discussed in this section (e.g., weeds, fire, and off-highway vehicle [OHV] use). The level of information presented in this chapter is used to help assess potential effects of the action alternatives in Chapter 4.

Because acre figures and other numbers used are approximate projections, readers should not infer that they reflect exact measurements or precise calculations. Acreages were calculated using geographic information systems (GIS) technology and there may be slight variations in total acres between resources.

HOW TO READ THIS CHAPTER

This chapter is organized into four sections, including Resources, Resource Uses, Special Designations, and Social and Economic Conditions. These sections are further divided into resources or programs, which are also presented in Chapter 3.

For a description of the affected environment, see below or, for electronic drafts, click on the following link to take you to a specific section:

RESOURCES: Air Resources and Climate, Cultural Resources, Fish and Wildlife, (Aquatics, Terrestrial, and Special Status Species) Geology, Invasive Species (Vegetation), Lands with Wilderness Characteristics, Paleontological Resources, Riparian and Wetland Areas, Soils, Special Status Species-Plants, Vegetation, Visual Resources, Water Resources, Wildland Fire Management and Ecology

RESOURCE USES: Coal, Forestry and Woodland Products, Geothermal, Lands and Realty, Livestock Grazing, Locatable Minerals, Minerals, Mineral Materials, Oil and Gas, Recreation, Renewable Energy, Travel Management and OHV

SPECIAL DESIGNATIONS: Areas of Critical Environmental Concern, Back Country Byways, National Trails, Special Designation Areas, Wild and Scenic Rivers, Wilderness, Wilderness Study Areas

SOCIAL AND ECONOMIC CONDITIONS: Environmental Justice, Hazardous Materials and Waste, Social and Economic, Tribal Interests

RESOURCES

AIR RESOURCES AND CLIMATE

The air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. Pollutant transport from specific source areas is affected by local topography and meteorology. In the mountainous western United States, topography is particularly important in channeling pollutants along valleys, creating upslope and downslope circulations that may entrain airborne pollutants and block the flow of pollutants toward certain areas. In general, local effects are super-imposed on the general synoptic weather regime and are most important when the large-scale wind flow is weak.

This section begins with a description of current climate and currently identified climate change trends. Following this discussion, air resources will be described in terms of air quality, air quality related values (AQRV), specifically acid deposition and visibility, current emissions in the planning area, and smoke management.

CLIMATE

Climate is the combination of temperature, humidity, atmospheric pressure, wind, rainfall, sunshine, cloudiness, and other meteorological characteristics in a given region over a long period of time. Climate differs from weather, which is the present condition of these characteristics and their variations over shorter periods. Climate change involves long-term trends indicating a noticeable shift in climate.

Primary climate indicators that can be monitored include ambient air temperature, atmospheric pressure, wind, relative humidity, precipitation amounts and timing, annual snowpack levels, streamflow volume and timing, and solar radiation.

Current Conditions

The planning area is within the Great Plains-Palouse Dry Steppe Province (Eco-region 331) of the Temperate Steppe Division (Division 330) in the Dry Domain (Bailey 1995). The planning area is in the rain shadow of the Rocky Mountains and is characterized as a semi-arid continental regime of the Great Plains grasslands.

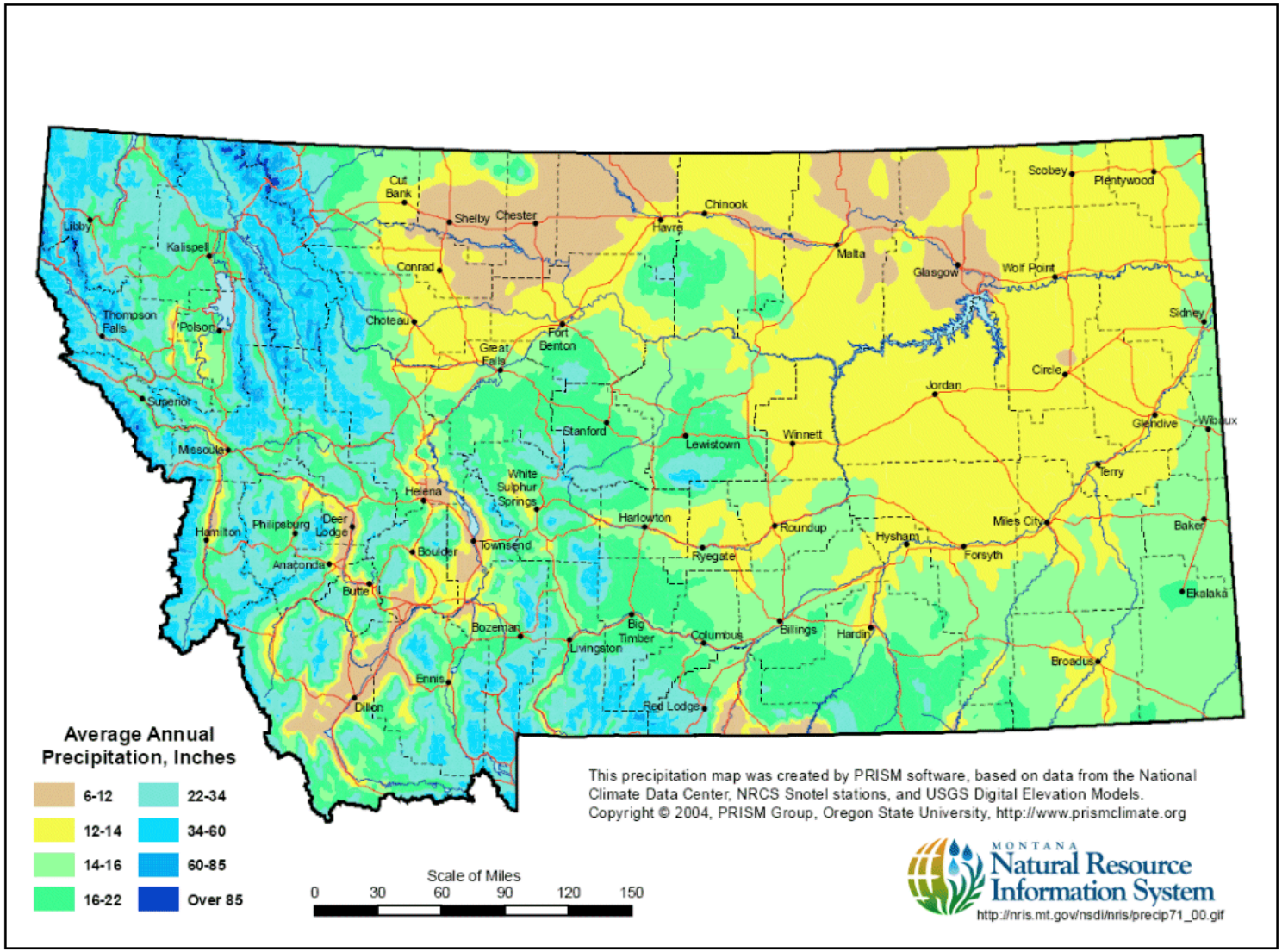
Average annual temperature is about 45 degrees Fahrenheit (°F). Winters are cold and dry while the summers are warm to hot. The frost-free season ranges from 90 days per year in the north to up to 140 days in the central and southern portions of the planning area. Maximum rainfall occurs in summer, with about 10 inches of precipitation per year. Because evaporation exceeds precipitation, the total supply of moisture is low.

Specific climate data from seven Cooperative Observer Program weather stations (Baker, Broadus, Glendive, Jordan, Lame Deer, Miles City, and Sidney) within the planning area are shown in Tables 1 through 7 in the *Air Resources and Climate Appendix*. Data for each site spans 50 or more years. The average annual temperature is approximately 45 °F at most of the sites. Winters are cold and dry, with the lowest average minimum monthly temperature occurring in January and varying from 1°F in Sidney to 9.4°F in Baker. Summers are warm to hot with average maximum monthly temperatures occurring in July and varying from 84.9°F in Sidney to 90.7°F in Baker. The frost-free season ranges from 100 days per year in the north to more than 200 days further east.

Mean annual precipitation at locations throughout the planning area varies from 11.7 to approximately 15.0 inches (Tables 1 through 7 in the *Air Resources and Climate Appendix* and Figure 3-1 here). Maximum rainfall occurs in summer. Because evaporation exceeds precipitation, the total supply of moisture is low. Average total annual snowfall varies from 27.4 to 46.3 inches (Tables 1 through 7 in the *Air Resources and Climate Append*ix).

Based on hourly wind data from airport locations in Baker, Glendive, Jordan, Miles City, and Sidney (Table 8 in the *Air Resources and Climate Appendix*), average annual wind speeds varied over the region from 8.6 to 11.1 miles per hour (mph), while the average monthly wind speeds varied from approximately 7.7 to 12.7 mph.

FIGURE 3-1.
AVERAGE ANNUAL PRECIPITATION IN MONTANA (1971 TO 2000)



Source: MNRIS 2004

March, April, and May are typically the windiest months of the year. Wind roses shown in Figures 1 through 5 of the *Air Resources and Climate Appendix* illustrate wind direction and wind speed at five locations within the planning area. Each wind rose consists of 16 arms whose radial positions indicate the frequency of wind blowing from the indicated direction. Longer arms indicate that the wind more frequently originates from the illustrated direction. Colored bands within each arm indicate the proportion of time that the wind blows with a given speed.

Trends

Climate trends are discussed in the *Climate Change* section.

CLIMATE CHANGE

Climate change includes two separate issues: cause and effect. Climate change is caused by physical and chemical changes in the environment, such as increased atmospheric concentrations of greenhouse gases (GHGs) and changes in albedo (surface reflectivity). The effects of climate change are widespread and include changes in climate indicators, such as temperature and precipitation, as well as effects on many natural resources, including air quality, water quality, flora, fauna, and many other resources on local, regional, national, and global scales. Climate change also affects human health and economic resources.

Primary climate change indicators that can be monitored are similar to those for climate, with some additions. Atmospheric concentrations of GHGs, surface albedo, and ocean temperatures are also important climate change indicators, although these additional indicators are not monitored in the planning area.

Current Conditions

The Intergovernmental Panel on Climate Change (IPCC) concluded that "warming of the climate system is unequivocal" (IPCC 2007b, p. 5) and "most of the observed increase in global average temperatures since the mid-20th century is very *likely* due to the observed increase in anthropogenic greenhouse gas concentrations" (IPCC 2007b, p. 10). Chapter 9 of *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* addressed the causes of climate change. Some of the conclusions included:

- human-induced warming of the climate system is widespread,
- "it is *likely*" that there has been a substantial anthropogenic contribution to surface temperature increases since the mid-20th century, and
- surface temperature extremes have "*likely*" been affected by anthropogenic forcing.

As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty because they are based on well-known physical laws and documented trends.

The temperature of the planet's atmosphere is determined by the amount of solar radiation absorbed by the earth and its atmosphere. GHGs (primarily carbon dioxide [CO_2], methane [CH_4], and nitrous oxide [N_2O]) increase the earth's temperature by reducing the amount of solar energy that re-radiates back into space. In other words, more heat is trapped in the earth's atmosphere when atmospheric concentrations of GHGs are greater. While GHGs have occurred naturally for millennia and are necessary for life on earth, increased atmospheric concentrations of GHGs, as well as land use changes, are contributing to an increase in average global temperature (IPCC 2007b). This warming, which is associated with climatic variability that exceeds the historic norm, is known as climate change. Extensive explanations of climate change causes and effects are provided in the *Climate Change Supplementary Information Report: Montana, North Dakota, and South Dakota Bureau of Land Management*, *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, *Climate Change Indicators in the United States*, and *Global Climate Change Impacts in the United States*.

Table 3-1 summarizes annual GHG emissions for Montana, the United States, and the world. Annual emissions of GHGs are usually quantified in units of metric tons. A metric ton is equivalent to approximately 2,205 pounds (1.102 short tons). The combined effect of emissions of multiple GHGs is reported in terms of carbon dioxide equivalent (CO_2e), which is calculated by multiplying emissions by a global warming potential number that takes into account each gas's atmospheric longevity and its heat-trapping capability. The global warming potential of CO_2 is set at 1. The United States Environmental Protection Agency (USEPA) determined other GHGs' relative climate change potentials over a 100-year period. In USEPA regulations effective as of November 1, 2013, global warming potentials for CH_4 and N_2O are 21 and 310, respectively. The USEPA proposed to revised these global warming potentials to 25 (CH_4) and 298 (N_2O). CO_2e emissions given in this document are based on global warming potential values of 21 and 310 because data referenced for comparison purposes are based on these values.

TABLE 3-1. ESTIMATED ANNUAL GREENHOUSE GAS EMISSIONS*

Entity	Data Year	CO_2e Emissions (10^6 metric tons)
Montana	2007	50.4
United States	2009	6,633
Global	2004	49,000

***Emissions exclude GHG emissions and sequestration due to land use and land use changes.**

Other organizations, such as the IPCC, have set different global warming potentials and these vary depending on the time frame being analyzed. For example, estimates of CH_4's global warming potential over a 20-year period range from 72 to 105. The BLM uses the CH_4 global warming potentials that are specified in USEPA regulations and are used for GHG emission reporting under 40 *Code of Regulations* Part 98 as of November 1, 2013. This approach allows for consistent comparisons with state and national GHG emission inventories. The BLM also provides estimated CH_4 and N_2O emission quantities in Chapter 4, which allow the public to use other global warming potentials to calculate CO_2e, if desired.

Planning area GHG emission sources include combustion equipment such as heaters and engines, oil and gas development and production, coal mining, fire events, motorized vehicle use (construction equipment, cars and trucks, and OHVs), livestock grazing, facilities development, and exhaust and fugitive emissions from other equipment. Contributions to climate change also result from land use changes (conversion of land to less reflective surfaces that absorb heat, such as concrete or pavement), changes in vegetation, and soil erosion (which can reduce snow's solar reflectivity and contribute to faster snowmelt). Emission controls on some sources can reduce GHG emissions.

Global atmospheric concentrations of GHGs are determined by the quantity of GHGs emitted to and removed from the atmosphere. Global concentrations of CO_2, CH_4, and N_2O in 2009 were 387 parts per million (ppm), 1,744 parts per billion (ppb), and 323 ppb, respectively (USEPA 2011c). More recently, the CO_2 concentration monitored at the Manua Loa Observatory surpassed 400 ppm for the first time in May 2013. Atmospheric concentrations of CO_2 can be reduced by carbon storage in forests, woodlands, and rangelands, as well as in underground carbon sequestration projects. Vegetation management can provide a source of CO_2 (e.g., prescribed burns) or it can provide a sink of CO_2 through vegetation growth. The net storage or loss of carbon on rangelands and grasslands in the planning area is generally small and difficult to estimate or measure. Most soils within the planning area contain relatively little organic matter compared to forest soils (forests and woodlands compose approximately 7 percent of the total acres on public lands in the planning area).

Trends

Climate change trends include two types of trends: historic and predicted. Historic trends describe climate changes that have already been observed. Predicted climate change indicates modeled future changes based on assumptions of future global GHG emission and resulting environmental effects. Climate change will continue into the future even if GHG emissions remain at current levels or decrease. Long lag times are associated with

the massive thermal energy stored in oceans, which can take decades, or even centuries, to adjust to climate changes (USEPA 2010i). In addition, the long lifetimes of many GHGs contribute to committed climate change. For example, CO_2 typically remains in the atmosphere for 50 to 200 years, depending on how long it takes CO_2 molecules to be absorbed by plants, land, or the ocean. Nitrous oxide (N_2O) is also long lived; it remains in the atmosphere for approximately 120 years. In contrast, CH_4 has a shorter lifetime and remains in the atmosphere for approximately 12 years (USEPA 2010i). Additional types of GHGs also contribute to climate change, but their impact is substantially less because of their relatively small concentrations in the atmosphere.

Temperature and Precipitation

Historical global mean surface temperatures have increased nearly 1.3°F from 1906 through 2008 (GISS and Sato 2010). Northern latitudes (above 23.6 through 90.0° N) have exhibited greater temperature increases of nearly 2.1°F since 1900, with nearly a 1.8 °F increase since 1970 alone (GISS and Sato 2010). In the planning area, data from 1941 through 2005 indicate a long-term temperature increase between 0.40 to 0.80°F per decade since 1976 (Figure 3-2). Over a recent 32-year period, planning area observed winter temperatures increased up to 7°F (see Figure 7 in the *Air Resources and Climate Appendix)* (Karl, Melillo, and Peterson 2009). With regard to precipitation, data from 1931 through 2005 indicated little change in total annual precipitation in eastern Montana since 1976. However, the timing of precipitation may have changed.

Predictions of future temperature changes compared to a 1961 to 1979 baseline indicate that temperatures in the planning area may increase 2 to 3°F by 2010 to 2029 (Figure 3-3). Temperatures are predicted to continue increasing through the century by 3 to 5°F by the mid-21st century and increase by 5 to 9°F by the end of the century, compared to the 1961 to 1979 baseline (see Figure 6 in the *Air Resources and Climate Appendix*) (Karl et al. 2009). The lower end of these ranges is based on a lower future GHG emission scenario, while the upper end of the ranges is based on a higher GHG emission scenario. Along with generally increasing temperatures, many more days are predicted to have maximum temperatures greater than 100°F (see Figure 8 in the *Air Resources and Climate Appendix*) (Karl et al. 2009). In 2001, the IPCC indicated that by the year 2100, global average surface temperatures would increase 2.5 to 10.4°F above 1990 levels (IPCC 2001). The National Academy of Sciences confirmed these findings, but also indicated that there are uncertainties regarding how climate change may affect different regions (NAS 2008). Computer model predictions indicate that increases in temperature will not be equally distributed but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures. Rising temperatures would increase water vapor in the atmosphere and reduce soil moisture, increasing generalized drought conditions while at the same time enhancing heavy storm events.

Prediction of future precipitation changes from the recent past to 2080 to 2099 indicate that precipitation in the planning area will increase 15 to 20 percent in winter and spring and decrease no more than 5 percent in summer. During fall, precipitation in the northern part of the planning area will increase by up to 5 percent while the southern portion of the planning will experience a 0- to 5-percent decrease (see Figure 9 in the *Air Resources and Climate Appendix*) (Karl et al. 2009).

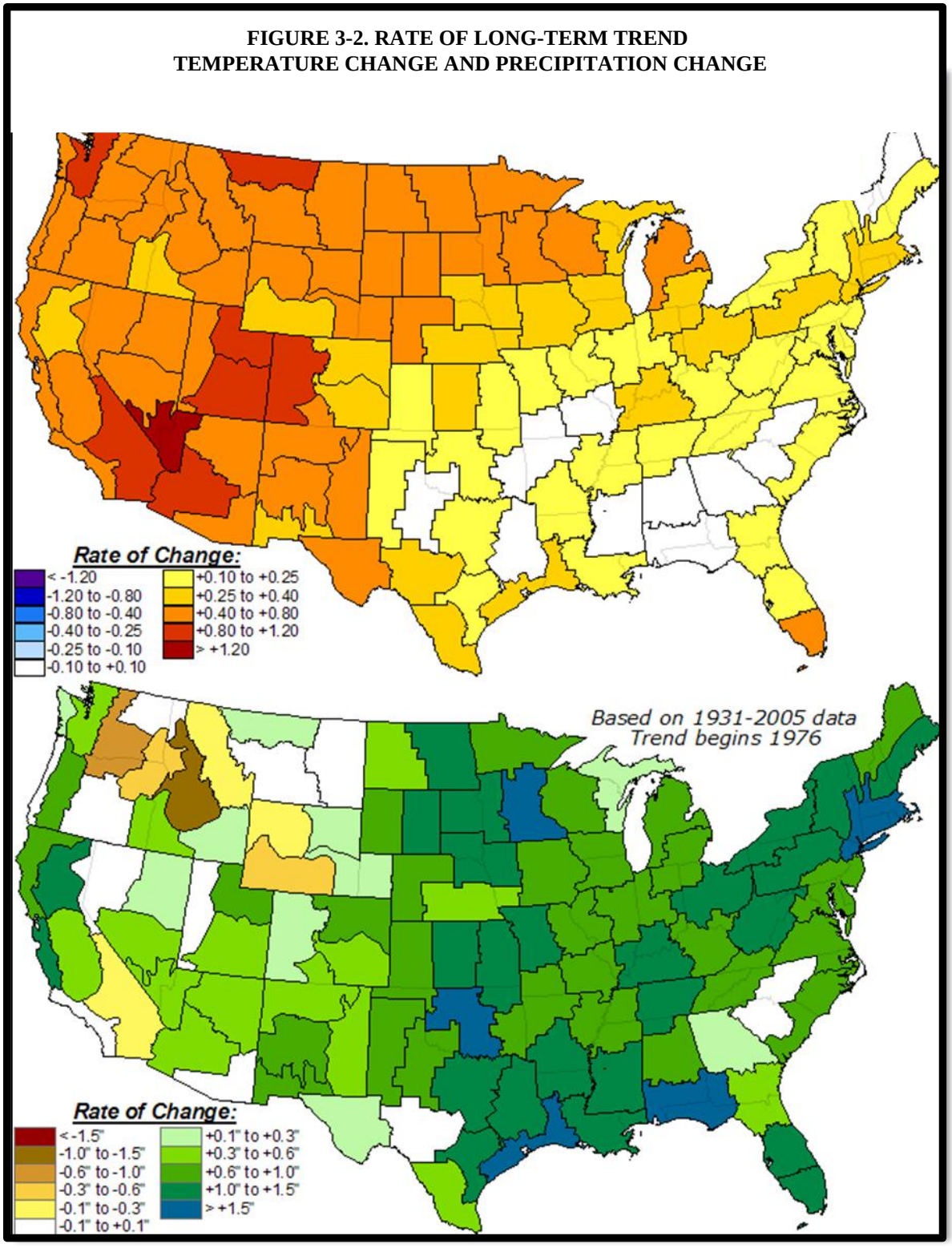
In addition to temperature and total precipitation changes, predicted climate changes include changes in precipitation timing by season and an increase in extreme rainfall events and other extreme weather events. Warming temperatures, melting glaciers, and thermal expansion within the seawater will cause ocean levels to rise. These changes will affect a broad array of ecosystems and affect food supplies and human health.

Climate Change Impacts on Resources

Climate change affects nearly all resources at local, regional, and global levels. The impacts of climate change are so widespread that they cannot all be described in this RMP. To illustrate the effects of global temperature change, Figure 3-4 provides broad examples of climate change impacts. As global temperatures increase, impacts to resources become more significant.

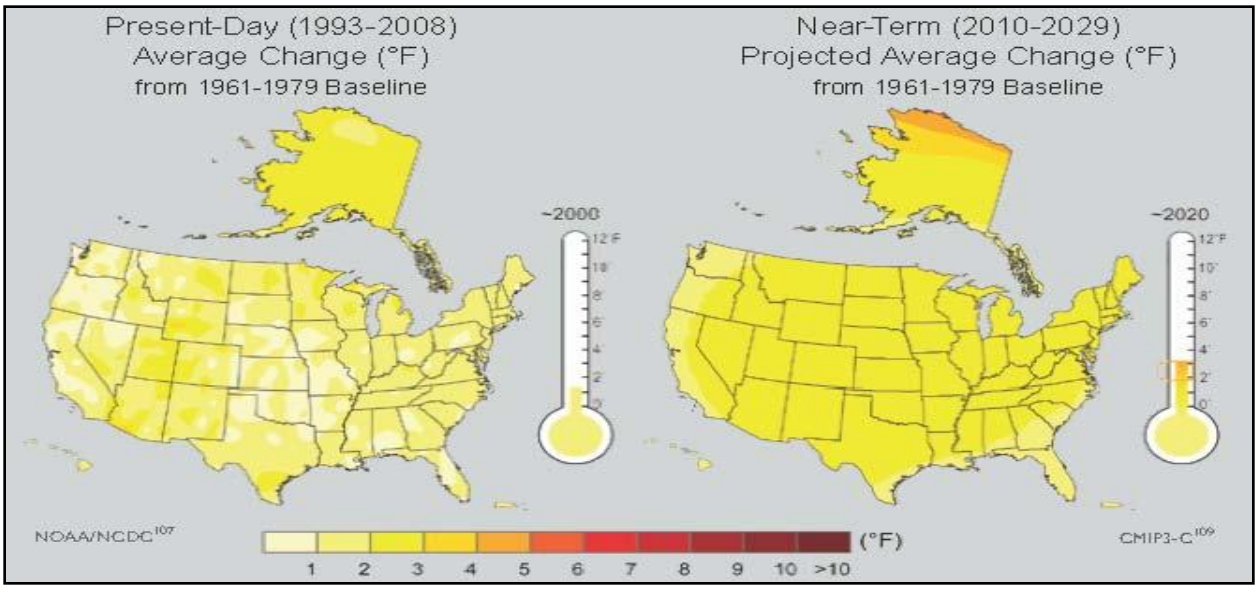
Temperature and precipitation changes could directly affect air quality. Air quality would be improved if increased precipitation reduces wind-blown dust but degraded if dry periods caused increased particulate

**FIGURE 3-2. RATE OF LONG-TERM TREND
TEMPERATURE CHANGE AND PRECIPITATION CHANGE**



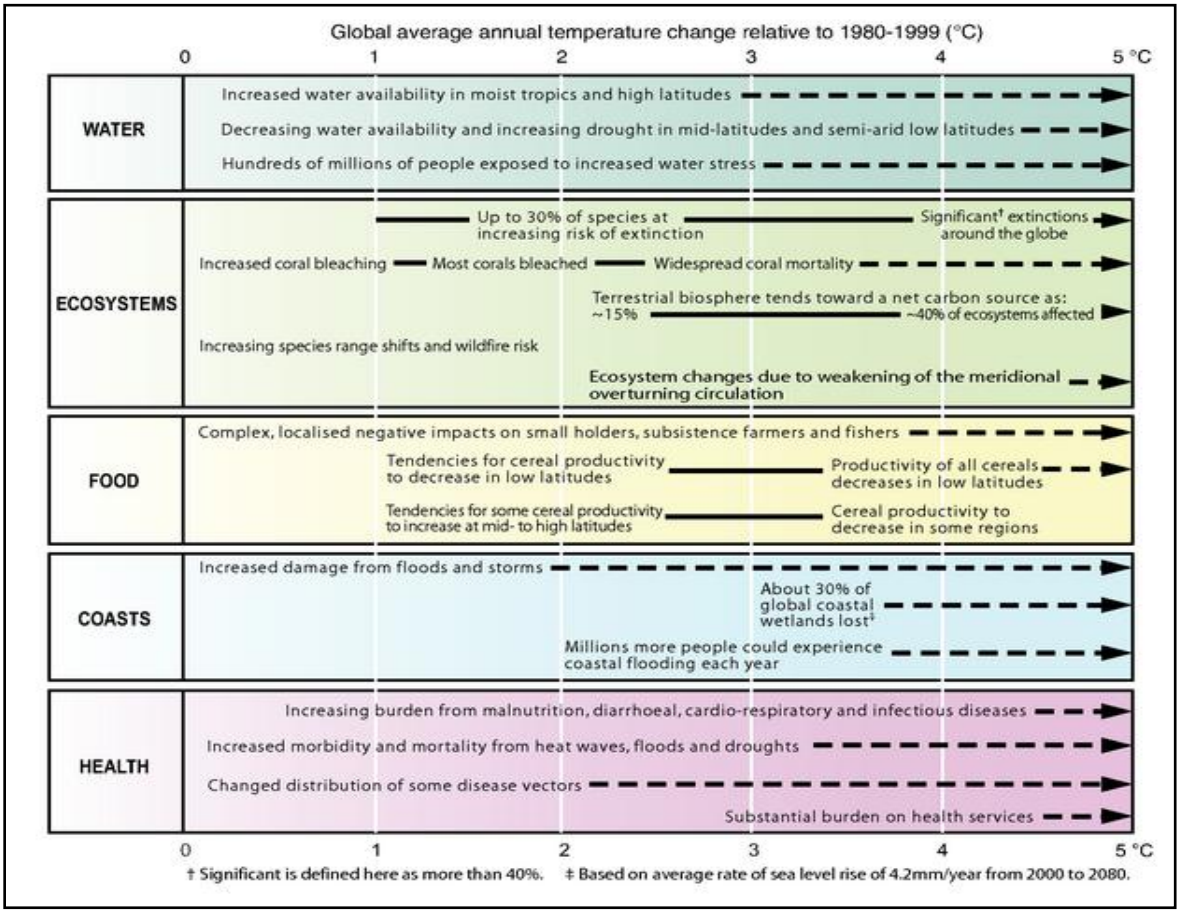
Source: NOAA 2010a

FIGURE 3-3.
NEAR-TERM PREDICTED TEMPERATURE INCREASES



Source: Karl et al. 2009

FIGURE 3-4.
EXAMPLES OF RESOURCE IMPACTS FROM CLIMATE CHANGE



Source: IPCC 2007b

emissions. Ground-level ozone (O_3) may also be affected. High temperatures are a contributing factor in ground-level O_3 formation, which is highly dependent on nitrogen oxides (NO_x) and volatile organic compound (VOC) concentrations. End-of-century O_3 concentrations in the planning area are predicted to decrease during the months of June through August based on a lower GHG emission scenario and increase based on a higher emission scenario (Figure 10 of the *Air Resources and Climate Appendix*) (Karl et al. 2009).

Climate change will affect water quality in the planning area. Increasing temperatures in the planning area are likely to contribute to increased evaporation, drought frequencies, and declining water quantity. The warming of lakes and rivers will adversely affect the thermal structure and water quality of hydrological systems, which will add additional stress to water resources in the region (IPCC 2007b). The planning area depends on temperature-sensitive springtime snowpack to meet demand for water from municipal, industrial, agricultural, recreational uses, and BLM-authorized activities. The United States Geological Survey (USGS) notes that mountain ecosystems in the western United States are particularly sensitive to climate change, particularly in the higher elevations (where much of the snowpack occurs) that have experienced three times the global average temperature increase over the past century (USGS 2010a). Higher temperatures are causing more winter precipitation to fall as rain rather than snow, which contributes to earlier snowmelt. Additional declines in snowmelt associated with climate change are projected which would reduce the amount of water available during summer (Karl et al. 2009). Rapid spring snowmelt resulting from sudden and unseasonal temperature increases can also lead to greater erosive events and unstable soil conditions.

Increases in average summer temperatures and earlier spring snowmelt in the planning area are expected to increase the risk of wildfires by increasing summer moisture deficits (Karl et al. 2009). Studies have shown that earlier snowmelts can lead to a longer dry season, which increases the incidence of catastrophic fire (Westerling, Hidalgo, Cayan, and Swetnam 2006b). Together with historic changes in land use, climate change is anticipated to increase the occurrence of wildfire throughout the western United States. Predicted climate change impacts to wildfires show large increases in the annual average acreage burned. Based on modeling that assumed a 1°Celsius (1.8°F) increase in global average temperature, a 393 percent increase in acreage burned in wildfires is predicted in the planning area (see Figure 11 in the *Air Resources and Climate Appendix*) (Karl et al. 2009). Air quality, ecosystem, and economic impacts from wildfires are extensive. Wildfires also release large quantities of CO_2 that would increase atmospheric GHG concentrations.

There is evidence that recent warming is affecting terrestrial and aquatic biological systems (IPCC 2007b). Warming temperatures are leading to earlier timing of spring events such as leaf unfolding, bird migration, and egg-laying (IPCC 2007b). The range of many plant and animal species has shifted poleward and to higher elevations, as the climate of these species' traditional habitats change. As future changes in climate are predicted to be greater than recent changes, there will likely be larger range shifts in the coming decades (Lawler et al. 2009). Warming temperatures are also linked to earlier vegetation growth in the spring and longer thermal growing seasons (IPCC 2007b). In aquatic habitats, increases in algae abundance in high-altitude lakes have been linked to warmer temperatures, and range changes and earlier fish migrations in rivers have been observed (IPCC 2007b). Climate change is likely to combine with other human-induced stressors to further increase the vulnerability of ecosystems to additional pests, additional invasive species, and loss of native species. Climate change is likely to affect breeding patterns, water and food supply, and habitat availability to some degree. Sensitive species in the planning area, such as greater sage-grouse, which are already stressed by declining habitat, increased development, and other factors, could experience additional pressures because of climate change.

High-frequency flooding events, erosion, wildfires, and hotter temperatures pose increased threats to cultural and paleontological sites and artifacts. Heat from wildfires, suppression activities, and equipment, as well as greater ambient daytime heat can damage sensitive cultural resources. Similarly, flooding and erosion can wash away artifacts and damage cultural and paleontological sites. However, these same events may also uncover and promote discoveries of new cultural and paleontological localities.

Climate change also poses challenges for many resource uses on BLM-administered lands. Increased temperatures, drought, and evaporation may reduce seasonal water supplies for livestock and could impact forage availability. However, in non-drought years, longer growing seasons resulting from thermal increases may increase forage availability throughout the year. Shifts in wildlife habitat resulting from climate change

may influence hunting and fishing activities, and early snowmelt may affect winter and water-based recreational activities. Drought and resulting stress on vegetation is likely to increase the frequency and intensity of mountain bark beetle and other insect infestations, which further increases the risk of fire and reduces the potential for sale of forest products on BLM-administered lands.

National Action to Reduce GHGs

United States GHG emissions are expected to decline as a result of the USEPA's listing of GHGs as a regulated air pollutant and the implementation of several recent GHG regulatory programs. Facilities with large emissions of GHGs must report these emissions to the USEPA, and new facilities with large expected GHG emissions must obtain air quality permits and potentially control GHG emissions. With regard to oil and gas activities, USEPA regulations in 40 Code of Federal (CFR) Regulations Part 60, Subpart OOOO require emission controls or reductions on hydraulically fractured gas wells, oil and condensate storage tanks, gas venting, and equipment leaks that are predicted to reduce national CH_4 emissions by 1 million tons per year. These regulations became effective on October 15, 2012.

The USEPA also requires facilities that emit more than 25,000 metric tons per year of CO_2e report emissions on an annual basis. Regulations for this reporting program were promulgated under the Greenhouse Gas Mandatory Reporting Rule in 40 CFR Part 98. While most types of sources began reporting emissions for calendar year 2010, onshore oil and gas sources began reporting emissions for calendar year 2011. The USEPA's Facility Level Information on GreenHouse Gases Tool (FLIGHT) website providing public access to the data became operational in April 2013 (USEPA 2013). The BLM obtained data in June and September 2013, and assessed emissions and emission sources for calendar year 2011.

No coal mines on BLM surface or mineral estate within the planning area reported emissions (USEPA 2013b). Because only underground mines are required to report, it is possible that some surface mines could have had emissions exceeding 25,000 mtpy CO_2e and were not required to report.

Eighteen oil and gas companies reported activities within the planning area that contributed to emissions exceeding the 25,000 mtpy reporting threshold (USEPA 2013b). USEPA regulations require that onshore oil and gas facilities report total GHG emissions for each oil and gas basin in which they operate. Portions of three basins are included in the planning area: Williston Basin, Powder River Basin, and Big Horn Basin. Of these, emissions from oil and gas well sites were reported only for the Williston Basin. Each company reporting Williston Basin emissions included emissions from operations in North Dakota. A method to separate MCFO-specific emissions from North Dakota emissions was not available.

Within the Williston Basin as a whole, including the planning area and western portions of North Dakota and South Dakota, CO_2 accounted for 85 percent of CO_2e emissions, while CH_4 accounted for 15 percent of CO_2e emissions. Table 3-2 provides a summary of the largest source types for CO_2 and CH_4 emissions.

The following types of oil and gas CH_4 emission sources accounted for less than 1 percent of CO_2e emissions based on Williston Basin FLIGHT data (USEPA 2013b):

- Acid gas removal (zero CH_4 emissions)
- Blowdown vent stacks (zero CH_4 emissions)
- Centrifugal compressors (zero CH_4 emissions)
- Dehydrators
- Enhanced oil recovery injection pump blowdown (zero CH_4 emissions)
- Flare stacks
- Natural gas pneumatic pumps
- Natural gas pneumatic devices
- Reciprocating compressors
- Transmission tanks (zero CH_4 emissions)
- Well testing venting and flaring
- Well venting and liquids unloading

TABLE 3-2.
OIL AND GAS GHG EMISSION SOURCES

Oil and Gas Source Type	Percentage of Total CH_4 Emissions	Percentage of Total CO_2 Emissions	Percentage of Total CO_2e Emissions	Is Source Subject to Regulation That Will Reduce Future CH_4 Emissions?
Associated gas venting and flaring	28%	38%	37%	Yes
Gas well completions and workovers	27%	2%	6%	Yes
Gas from produced oil sent to atmospheric tanks	19%	10%	12%	Yes
Other equipment leaks	9%	<0.1%	1%	Yes
Natural gas pneumatic devices	6%	<0.1%	1%	Yes
Flare stacks	6%	24%	21%	No
Other sources	3%	4%	1%	---
Natural gas distribution combustion equipment	2%	24%	21%	No
Total	100%	100%	100%	

Source: Derived from GHG emissions reported for calendar year 2011 under the USEPA GHG Mandatory Reporting Rule for the entire Williston Basin. Reported emissions include oil and gas companies with 25,000 mtpy or more CO_2e emissions within the Williston Basin. (USEPA 2013b)

A trade-off exists between CH_4 and CO_2 emissions. Combustion of CH_4 contained in natural gas decreases CH_4 emissions while increasing CO_2 emissions. Flaring of natural gas is an example of this trade-off. Natural gas produced during oil production is known as associated gas. Flaring and venting of associated gas is the largest source of CH_4 emissions in the Williston Basin. Much of this gas can be captured and sold if infrastructure, such as pipelines, is available to transport the gas to natural gas plants and end users. Due to rapid development in the Williston Basin and long distances to areas with large populations, pipelines and other infrastructure have not kept pace with associated gas produced from oil wells in the Bakken Field within the Williston area. Associated gas flaring and venting within the planning area is less frequent than in the North Dakota portion of the Bakken Field due to lower oil well development rates in the planning area.

Within the United States Department of the Interior (USDI), several initiatives have been launched to improve the ability to understand, predict, and adapt to the challenges of climate change. The Secretary of the Interior signed Secretarial Order 3289 on February 22, 2010, establishing a Department-wide, science-based approach to increase understanding of climate change and to coordinate an effective response to impacts on managed resources. The order reiterated the importance of analyzing potential climate change impacts when undertaking long-range planning issues and established several initiatives including the development of eight Regional Climate Science Centers. Regional Climate Science Centers would provide scientific information and tools that land and resource managers can apply to monitor and adapt to climate changes at regional and local scales. The North Central Climate Science Center, which will incorporate the planning area, has a target establishment date of 2011.

Given the broad spatial influence of climate change, which requires response at the landscape-level, the USDI also established Landscape Conservation Cooperatives, which are management-science partnerships that help to inform management actions addressing climate change across landscapes. These Cooperatives, which are formed and directed by land, water, wildlife, and cultural resource managers and interested public and private organizations, are designed to increase the scope of climate change response beyond federal lands.

Rapid ecoregional assessments are one of the tools the BLM uses to monitor and respond to the effects of climate change. Ecoregional assessments are geospatial landscape evaluations designed to identify areas of high ecological value within an ecoregion that may warrant conservation, adaptation, or restoration. These assessments can help to identify resources that are being affected by climate change and provide information to facilitate the subsequent development of an ecoregional conservation strategy for plants, wildlife, and fish communities on public lands. Ecoregional assessments can identify changes in climatic conditions and areas, species, and ecological features and services that are sensitive to ecosystem instability. One of the objectives of

the BLM rapid ecoregional assessment is to provide guidance for adaptation and mitigation planning in response to climate change.

In addition to efforts to better respond and adapt to climate change, other federal initiatives are being implemented to mitigate climate change. The Carbon Storage Project was implemented to develop carbon sequestration methodologies for geological (i.e., underground) and biological (e.g., forests and rangelands) carbon storage. The project is a collaboration of federal agency and external stakeholders to enhance carbon storage in geologic formations and plants and soils in an environmentally responsible manner. The Carbon Footprint Project is a project to develop a unified GHG-emission reduction program for the USDI, including setting a baseline and reduction goal for the Department's GHG emissions and energy use. More information about the USDI's efforts to respond to climate change is available at: http://www.doi.gov/archive/climatechange/.

AIR QUALITY

Indicators

Air quality indicators include air pollutant concentrations, which indicate the quality of the air humans breathe. AQRVs include other air resource characteristics such as light transmission (i.e., visibility) and acidic deposition. This RMP addresses air quality within the study area, which extends beyond the planning area and includes nearby areas in which air quality could potentially be affected by activities within the planning area. In some cases, data sources used to describe air resource characteristics in the planning area are located outside of the planning area.

Air pollutant concentration monitoring networks in Montana include the State and Local Air Monitoring Stations (SLAMS), a National Core (NCore) monitoring site. Tribal monitoring networks, and the Clean Air Status and Trends Network (CASTNet). SLAMS are usually located in urban areas and measure criteria pollutants. The Montana Department of Environmental Quality (MDEQ) operates the SLAMS network within Montana to determine compliance with regulatory concentration standards and the NCore site to determine long-term trends in a relatively pristine area. CASTNet stations are located in remote areas and measure concentrations of compounds of interest to ecosystem health. Air pollutant concentrations are usually reported on a volume basis as ppm or ppb for gaseous substances and on a mass basis as micrograms per cubic meter ($\mu g/m^3$) for solid substances such as particulate.

Monitors that provide information on AQRVs include the National Acid Deposition Program (NADP) network and the Interagency Monitoring of Protected Visual Environments (IMPROVE) network. Table 3-3 provides a list of monitoring stations in or near the planning area.

Current Conditions

Criteria Air Pollutants

Criteria air pollutants are those for which national health-based concentration standards have been established under the National Ambient Air Quality Standards (NAAQS) program. Criteria air pollutants include carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), O_3, particulate matter with a diameter less than or equal to 10 microns (PM_{10}), fine particulate matter (diameter less than or equal to 2.5 microns) ($PM_{2.5}$), and sulfur dioxide (SO_2). Criteria air pollutant concentrations are compared to NAAQS (USEPA 2010c) and Montana Ambient Air Quality Standards (MAAQS) (Table 3-4). The NAAQS include both primary and secondary standards. Primary standards protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation and buildings.

The MDEQ performs regulatory monitoring of NO_2, O_3, SO_2, particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$) to determine compliance with NAAQS and MAAQS. Areas that do not meet federal standards are known as nonattainment areas. The community of Lame Deer in Rosebud County is the only nonattainment area within the planning area; it is designated nonattainment for particulate matter (PM_{10}). Montana counties

containing nonattainment areas are shown in Map 20. The actual geographic extent of the Lame Deer nonattainment area is much smaller than the shaded county shown on the map. Similarly, the SO_2 nonattainment area in nearby Yellowstone County is limited to a small area in Laurel, Montana. Several other nonattainment areas are restricted to portions of the counties highlighted on the map. The entire state of Montana is considered to be attainment for CO, NO_2, and O_3, while small areas are nonattainment for particulate matter (PM_{10} and $PM_{2.5}$), lead, and SO_2.

TABLE 3-3.
AIR QUALITY MONITORING STATIONS IN THE PLANNING AREA OR VICINITY

Monitoring System	Station Identifier	Pollutant or AQRV	Location	Lat	Long
SLAMS	30-111-0066	SO_2	Billings-Coburn Road	45.7883	-108.4595
	30-111-0085	$PM_{2.5}$	Billings-St. Luke's	45.7822	-108.5115
	30-087-0001	NO, NO_2, NO_x, O_3, PM_{10}, $PM_{2.5}$	Birney-Tongue River[1]	45.3662	-106.4898
	30-075-0001	NO, NO_2, NO_x, O_3, PM_{10}, $PM_{2.5}$	Broadus-Powder River[1]	45.4403	-105.3702
	30-083-0001	NO, NO_2, NO_x, O_3, SO_2, PM_{10}, $PM_{2.5}$	Sidney-Oil Field[1]	47.8034	-104.4856
CASTNET	THR422	O_3, SO_2, Deposition	Theodore Roosevelt National Park (North Dakota)	46.8947	-103.3778
NADP	MT00	Wet Deposition	Little Bighorn Battlefield National Monument	45.5686	-107.4375
	MT96	Wet Deposition	Poplar River	48.3100	-105.1000
	MT98	Wet Deposition	Havre-Northern Agricultural Research Center	48.4992	-109.7975
	ND00	Wet Deposition	Theodore Roosevelt National Park (North Dakota)	46.8951	-103.378
IMPROVE	FOPE1	Visibility	Fort Peck	48.308	-105.102
	MELA1	Visibility	Medicine Lake	48.4872	-104.476
	NOCH1	Visibility	Northern Cheyenne	45.6493	-106.557
	YELL2	Visibility	Yellowstone National Park (Wyoming)	44.5654	-110.4003
	NOAB1	Visibility	North Absaroka (Wyoming)	44.7448	-109.3816
	THRO1	Visibility	Theodore Roosevelt National Park (North Dakota)	44.8948	-103.3777
	ULBE1	Visibility	UL Bend	47.5823	-108.72

[1]On April 8, 2013, the USEPA approved MDEQ's request to redesignate the Birney, Broadus, and Sidney monitors as special purpose monitors producing non-regulatory data for PM_{10} due to monitor siting near a gravel road. The locations of these monitors do not meet monitor siting requirements for PM_{10}.

TABLE 3-4.
FEDERAL AND STATE AMBIENT AIR QUALITY STANDARDS

Pollutant	Federal NAAQS[1]			State MAAQS[2]
	Averaging Time	Level	Standard Type	Level
CO	8-hour	9 ppm[3]	Primary	9 ppm[12]
	1-hour	35 ppm[3]	Primary	23 ppm[12]
Fluoride in Forage	Monthly	N/A	N/A	50 µg/g
	Grazing Season	N/A	N/A	35 µg/g
Pb	3-month (rolling)	0.15 µg/m[3, 5]	Primary, Secondary	N/A
	90-day	N/A	N/A	1.5 µg/g[5]
NO_2	Annual	0.053 ppm[5]	Primary, Secondary	0.05 ppm[13]
	1-hour	0.100 ppm[10]	Primary	0.30 ppm[12]
$PM_{2.5}$	Annual	12.0 µg/m[3, 11]	Primary	N/A

TABLE 3-4.
FEDERAL AND STATE AMBIENT AIR QUALITY STANDARDS

	Annual	15.0 µg/m^3 [11]	Secondary	N/A
PM_{10}	Annual	N/A	N/A	50 µg/m^3 [3 4]
	24-hour	150 µg/m^3 [3, 8]	Primary, Secondary	150 µg/m^3
Settleable Particulate	30-day	N/A	N/A	10 g/m^2
O_3	8-hour	0.075 ppm [6]	Primary, Secondary	0.10 ppm [12]
SO_2	Annual	0.030 ppm [5]	Primary	0.02 ppm [13]
	24-hour	0.14 ppm [3]	Primary	0.10 ppm [12]
	3-hour	0.5 ppm [3]	Secondary	N/A
	1-hour	0.075 ppm [9]	Primary	0.50 ppm [14]
Visibility	Annual	N/A	N/A	3 x 10^{-5}/m [15]

[1]NAAQS are codified in Title 40 of the CFR Part 50.
[2]MAAQS are codified in Title 17, Chapter 8, Subchapter 2 of the Ambient Air Quality in the Administrative Rules of Montana (ARM).
[3]Not to be exceeded more than once per calendar year.
[4]Not to be exceeded more than once per year on average over 3 years.
[5]Not to be exceeded.
[6]Not to be exceeded, based on the 3-year average of the fourth-highest daily maximum 8-hour concentrations per calendar year.
[7]Not to be exceeded based on the 98th percentile of 24-hour concentrations at each population-oriented monitor.
[8]Not to be exceeded more than once per calendar year, based on a 3-year average of maximum 24-hour values.
[9]Not to be exceeded, based on a 3-year average of the 99th percentile of the daily maximum concentrations.
[10]Not to be exceeded, based on a 3-year average of the 98th percentile of the daily maximum concentrations.
[11]Not to be exceeded, based on a 3-year average of the weighted annual mean from one or more community monitors.
[12]Not to be exceeded more than once over any 12 consecutive months.
[13]Arithmetic average not to be exceeded more than once over any 4 consecutive quarters.
[14]Not to be exceeded more than 18 times in any 12 consecutive months.
[15]This standard applies only in certain Class I areas (Table 3-5).
µg/m^3 = micrograms per cubic meter

The sources and effects of each criteria pollutant are explained below. A summary of recent ambient air quality monitoring data is provided in Figure 3-5, which shows the percentage of the monitored concentration compared to the NAAQS. In addition to the monitor located in Sidney, Montana (Richland County), two monitors were established in the planning area during 2009 at Broadus (Powder River County) and Birney (Rosebud County). Two additional monitors became operational in Lewistown and Malta in mid-2012; these monitors have insufficient data for inclusion in Figure 3-5.

Carbon Monoxide

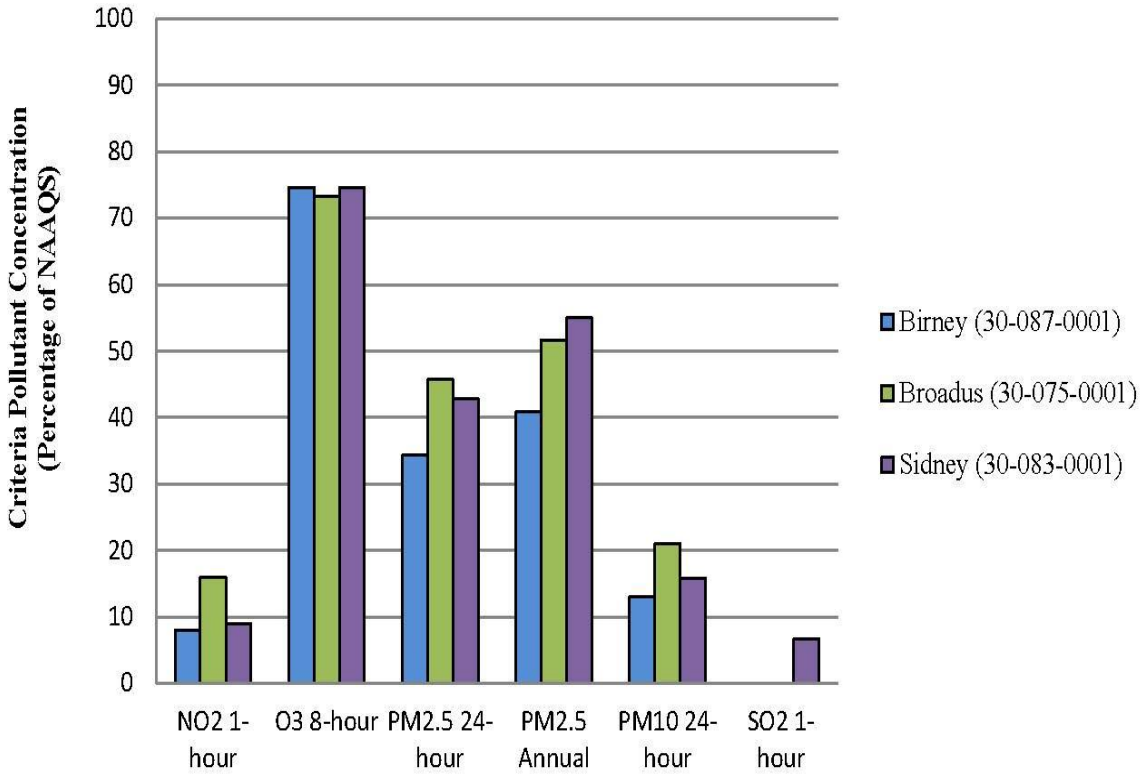
Carbon monoxide (CO) can have significant effects on human health because it combines readily with hemoglobin and consequently reduces the amount of oxygen transported in the bloodstream. Effects on humans from exposure to high CO concentrations can include slight headaches, nausea, or death.

Motor vehicles and other internal combustion engines are the dominant source of CO emissions in most areas. High CO levels develop primarily during winter when periods of light winds combine with ground-level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Carbon monoxide is also created during refuse, agricultural, and wood-stove burning and through some industrial processes. Carbon monoxide is not monitored within the planning area. Monitoring in prior years indicated extremely low CO concentrations and monitoring was discontinued.

Lead

The primary historical source of lead emissions has been certain types of industrial sources and lead in gasoline and diesel fuel. However, since lead in fuels has decreased substantially, the processing of metals containing trace amounts of lead is now the primary source of lead emissions. The highest levels of lead in air are generally found near lead smelters. Other stationary sources include waste incinerators, utilities, and lead-acid battery manufacturing plants. The effects of lead exposure include brain and other nervous system damage; children

FIGURE 3-5.
BACKGROUND CONCENTRATIONS IN THE PLANNING AREA 2010 TO 2012



Source: MDEQ 2013

exposed to lead are particularly at risk. Lead levels in the planning area are expected to be well below the NAAQS and MAAQS because the planning area does not contain large lead emissions sources.

Nitrogen Dioxide

Oxides of nitrogen, including nitric oxide (NO) and NO_2 are formed when naturally occurring atmospheric nitrogen and oxygen are combusted with fuel in automobiles, power plants, industrial processes, and home and office heating. At high exposures, NO_2 causes respiratory system damage of various types, including bronchial damage. Its effects are exhibited by increased susceptibility to respiratory infection and changes in lung function. Within the atmosphere, NO_2 contributes to visibility impacts and may be visible as reddish-brown haze. Nitrogen dioxide (and other NO_x compounds) also forms nitric acid, a component of atmospheric deposition (e.g., acid rain).

The 98th percentile 1-hour NO_2 concentrations at Birney, Broadus and Sidney were 8, 16 and 9 percent, respectively, of the NAAQS from 2010 to 2012.

Ozone

Ozone (O_3) is not emitted directly into the atmosphere. Instead, it is formed by photochemical reactions of precursor air pollutants, including VOCs and NO_x. These precursors are emitted by mobile sources, stationary combustion equipment, and other industrial sources. Ozone is produced year-round, but urban O_3 concentrations

are generally greatest during the summer months, when there is greater sunlight and increased air temperatures. Elevated O_3 concentrations may also occur during winter in snow-covered rural areas.

Particulate Matter

The 3-year average fourth highest 8-hour daily maximum O_3 concentrations at Birney, Broadus and Sidney were 75, 73 and 75 percent, respectively, of the NAAQS from 2010 to 2012.

Particulate matter includes PM_{10} (inhalable particles and aerosols less than or equal to 10 microns in diameter) and $PM_{2.5}$ (fine particles and aerosols less than or equal to 2.5 microns in diameter). Particulate matter (PM_{10}) impacts include health effects (because PM_{10} is small enough to reach the lungs when inhaled), deposition on plants and surfaces (including soiling of snow, which can contribute to climate change), localized reductions in visibility, and potential corrosion. Particulate matter (PM_{10}) emissions are generated by a variety of sources, including agricultural activities, industrial emissions, and road dust re-suspended by vehicle traffic. Within the planning area, primary sources of particulate matter (PM_{10}) include smoke from wildland fire, residential wood burning, street sand, physically disturbed soils, and dust from unpaved roads.

Fine particulate matter (smaller-sized $PM_{2.5}$) poses greater health concerns than particulate matter (PM_{10}) because fine particulate matter can pass through the nose and throat and become trapped deep in the lungs. Fine particulate also contributes to reduced visibility in nationally important areas such as national parks. Fine particulate matter ($PM_{2.5}$) emissions are primarily generated by internal combustion diesel engines, soils with high silt and clay content, and secondary aerosols formed by chemical reactions in the atmosphere.

The 2010 to 2012 three-year average second highest 24-hour particulate matter (PM_{10}) concentrations were 19.6, 31.5 and 23.8 $\mu g/m^3$ at the Birney, Broadus and Sidney monitoring sites, which is 13 to 21 percent of the corresponding primary and secondary NAAQS and MAAQS. The three-year average 98th percentile 24-hour fine particulate matter ($PM_{2.5}$) concentrations were 12, 16 and 15 $\mu g/m^3$ at the Birney, Broadus and Sidney sites, respectively, which were 34 to 46 percent of the corresponding primary and secondary NAAQS. The three-year average weighted mean fine particulate matter ($PM_{2.5}$) annual concentrations at the three sites were 41 to 55 percent of the corresponding primary and secondary NAAQS.

Sulfur Dioxide

Sulfur dioxide (SO_2) is a colorless gas with a pungent odor. Prolonged exposure to high levels of SO_2 can lead to respiratory failure, and SO_2 plays an important role in the aggravation of chronic respiratory illnesses such as asthma. Sulfur dioxide is emitted primarily from stationary sources that burn fossil fuels (i.e., coal and oil) containing trace amounts of elemental sulfur. Although other sources of SO_2 include metal smelters and petroleum refineries, SO_2 is also emitted on occasion from natural sources such as volcanoes. In the atmosphere, SO_2 converts to sulfuric acid, a component of atmospheric deposition (acid rain), and forms secondary aerosols, subsequently contributing to visibility impacts in nationally important areas.

The 2010-2012 average 99th percentile 1-hour SO_2 concentration was 5 ppb in Sidney. This concentration was 7 percent of the primary NAAQS and corresponds to less than 1 percent of the MAAQS. Sulfur dioxide concentrations are not measured at the Birney or Broadus monitors.

Volatile Organic Compounds

VOCs include a variety of chemicals, some of which may have adverse health effects. Concentrations of many VOCs are consistently higher indoors than outdoors. VOCs are emitted from thousands of products, including paints, cleaning supplies, pesticides, building materials, office equipment, glues, and permanent markers (USEPA 2010i). VOCs are not subject to a NAAQS. However, since they react with NO_x to form ground-level O_3, VOCs are a precursor to O_3 and regulated by the USEPA.

Hazardous Air Pollutants

Hazardous air pollutants (HAPs) are pollutants that are known or suspected to cause cancer or other serious health problems, including chronic respiratory disease, reproductive disorders, or birth defects. Of the 187 regulated HAPs, several are commonly emitted from planning area engines and other sources. Currently emitted HAPs include formaldehyde, benzene, toluene, ethyl benzene, xylenes, and hexane (i.e., n-hexane). Potential concentrations of HAPs are compared to health-based thresholds to estimate the risk of health effects.

Mercury is a HAP and its emissions are largely associated with large coal-burning facilities, such as electrical utilities. Ambient concentrations of mercury are not monitored within the planning area. During 2008, monitors in or near Montana indicated that ambient average mercury concentrations were 6.4 nanograms per liter (ng/L) in Glacier National Park, 8.8 ng/L in Yellowstone National Park, and 11.4 ng/L in the Lostwood Wilderness in North Dakota (see Figure 23 in the *Air Resources and Climate Appendix).*

Other Pollutants

Other air pollutants of interest include nitrogen and sulfur compounds, which contribute to acid deposition and regional haze. Nitrogen compounds include particulate nitrate (NO_3^-), nitric acid, and ammonium (NH_4^+), and sulfur compounds include particulate sulfate (SO_4^{-2}) and SO_2. Concentrations of nitric acid, SO_2, ammonium, particulate nitrate, and sulfate are low in Montana in relation to concentrations across the United States (see Figures 21 and 22 in the *Air Resources and Climate Appendix).*

Criteria Pollutant Emissions

Current air quality reflects the impacts of emissions of existing sources of air pollution. Table 3-5 provides an estimate of recent emissions within the MCFO based on a compilation of available emission inventory sources. HAP and GHG emissions are not included in Table 3-5 because these emissions are not reported to the MDEQ or USEPA by most sources. Some facilities within the MCFO have begun reporting GHG emissions to the USEPA under the GHG Mandatory Reporting Rule.

Trends

TABLE 3-5.
ESTIMATE OF CURRENT MCFO STATIONARY AND OIL AND GAS INDUSTRIAL EMISSIONS IN TONS PER YEAR

Source Group	CO	NO_1	VOC	SO_2	PM_{10}	$PM_{2.5}$
2010 Oil and Gas Well Sources[1]	2,796.3	2,404.4	12,356.5	22.4	407.4	147.4
2009 MDEQ and other point sources[2]	3,822.2	20,150.7	392.3	1,8115.9	4,302.3	126.2
2008 Non-road sources[3]	19,273.0	14,768.9	2,910.9	339.3	960.5	925.4
2008 On-road sources[3]	36,259.9	3,609.6	2,406.0	14.4	127.8	97.9
Current Estimate of Emissions	**62,151.4**	**40,933.6**	**18,065.**	**18,492.0**	**5,798.0**	**1,296.9**

Source: URS 2011
Emission estimates are provided in short tons per year. Emissions are not available for HAPs and GHGs.
[1]This source group does not include gas compression engine emissions, which are included in the MDEQ emission inventory.
[2]The MDEQ emission inventory includes stationary (i.e., "point") sources. Mobile sources such as cars, trucks, and OHVs (including heavy construction equipment) are not included in the inventory.
[3]These data were derived from Western Regional Air Partnership emission inventories.

Lead

No data are available to determine the trend in lead concentrations. However, decreasing lead levels in gasoline and diesel fuel indicate a likely decrease in lead levels within the planning area.

Nitrogen Dioxide

Hourly NO_2 concentrations in Sidney remained relatively constant from 2009 to 2011. In contrast, concentrations monitored at the Birney and Broadus monitors decreased from 2010 to 2011. One-hour NO_2, 98^{th} percentile concentrations, decreased by approximately 38 percent at Broadus and 22 percent at Birney.

With regard to annually averaged NO_2 concentrations, Sidney data show a decreasing trend from 2009 to 2011. Based on 2010 to 2011 data, average concentrations decreased by 15 percent at Birney and increased by 6 percent at Broadus.

Ozone

Ozone (O_3) concentrations based on fourth highest daily maximum 8-hour averages decreased by 10 percent from 2009 to 2011 at the Sidney monitor. Ozone concentrations also decreased at Birney and Broadus by 15 percent and 4 percent, respectively, from 2010 to 2011.

Particulate Matter

Particulate matter concentrations are affected by the weather, leading to substantial variability from year to year. Fine particulate matter ($PM_{2.5}$) 98^{th} percentile 24-hour concentrations were variable in Sidney (2009 to 2011), stable in Birney (2010 to 2011), and increased by approximately 21 percent in Broadus (2010 to 2011). With regard to particulate matter (PM_{10}), second maximum 24-hour concentrations were variable in Sidney from 2009 through 2011, and increased from 2010 to 2011 by approximately 16 percent and 54 percent in Birney and Broadus, respectively.

Sulfur Dioxide

Because the Sidney SO_2 monitor is new (2011), SO_2 concentration trends are not available.

Volatile Organic Compounds

VOC concentration trend data are not available.

Hazardous Air Pollutants

HAP concentration trend data are not available.

Other Pollutants

From 1999 through 2008, concentrations of nitrogen compounds, including particulate nitrate, nitric acid, and ammonium have been variable at Theodore Roosevelt National Park (see Figure 22 in the *Air Resources and Climate Appendix).* Mean annual concentrations of sulfur compounds (sulfate and SO_2) show a decreasing tend between 2001 and 2008 (see Figure 23 in the *Air Resources and Climate Appendix).*

AIR QUALITY RELATED VALUES

AQRVs include visibility or a specific scenic, cultural, physical, biological, ecological, or recreational resource identified for a particular area. Air pollution can impact AQRVs through ambient exposure to elevated atmospheric concentrations, such as O_3 effects to vegetation, through impairment of scenic views by pollution particles in the atmosphere, and through deposition of air pollutants, such as sulfur and nitrogen compounds, on the earth's surface through precipitation or dry deposition. AQRVs on federal lands are identified and managed within the respective jurisdictions of several land management agencies, including the United States Forest Service (USFS), National Park Service (NPS), United States Fish and Wildlife Service (USFWS), and BLM. Class I areas are afforded specific AQRV protection under the Clean Air Act. Class II areas may be analyzed to assess AQRV impacts if they are identified as sensitive Class II areas.

Table 3-6 lists Class I and sensitive Class II areas in or near the planning area. Federal mandatory and tribal (non-mandatory) Class I areas in or adjacent to the planning area include the Fort Peck Indian Reservation, Northern Cheyenne Indian Reservation, Medicine Lake Wilderness, and UL Bend Wilderness. Sensitive Class II areas within the planning area include the large Charles M Russell National Wildlife Refuge and Lamesteer National Wildlife Refuge. Additional Class I and sensitive Class II areas located near the planning area are shown in Table 3-6.

Current Conditions

Deposition

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems. Deposition is reported as the mass of material deposited on an area in a given period (e.g., kilogram per hectare per year [kg/ha-yr]). Wet deposition refers to air pollutants deposited by precipitation, such as rain and snow. One expression of wet deposition is precipitation pH, a measure of the acidity or alkalinity of the precipitation. Dry deposition refers to gravitational settling of particles and adherence of gaseous pollutants to soil, water, and vegetation. Total deposition refers to the sum of airborne material transferred to the Earth's surface by both wet and dry deposition. Total nitrogen deposition is calculated by summing the nitrogen portion of wet and dry deposition of nitrogen compounds, and total sulfur deposition is calculated by summing the sulfur portion of wet and dry deposition of sulfur compounds.

TABLE 3-6.
FEDERAL CLASS I AREAS AND SENSITIVE
CLASS II AREAS IN OR NEAR THE PLANNING AREA

	Class I Area	Jurisdictional Agency
Class I Areas	Badlands Wilderness	NPS
	Fort Peck Indian Reservation	Tribal
	Lostwood Wilderness	USFWS
	Medicine Lake Wilderness Area	USFWS
	Theodore Roosevelt National Park	NPS
	UL Bend Wilderness Area	USFWS
	Wind Cave National Park	NPS
Sensitive Class II Areas	Bowdoin National Wildlife Refuge	USFWS
	Charles M Russell National Wildlife Refuge	USFWS
	Crow Indian Reservation	Tribal
	Devil's Tower National Monument	NPS
	Lake Ilo National Wildlife Refuge	USFWS
	Lake Zahl National Wildlife Refuge	USFWS
	Lamesteer National Wildlife Refuge	USFWS
	Stewart Lake National Wildlife Refuge	USFWS
	White Lake National Wildlife Refuge	USFWS

The normal range of precipitation pH is 5.0 to 5.6 (Seinfeld 1986). Annual average precipitation pH in 2008 was approximately 5.3 at the Poplar River station (Figures 14 and 15 in the *Air Resources and Climate Appendix*). The planning area has low nitrate and ammonium deposition compared to the rest of the United States (see Figure 20 of the *Air Resources and Climate Appendix*).

Total nitrogen compound deposition at Theodore Roosevelt National Park was 2.8 kg/ha-yr in 2006. Nitrogen compound speciation indicates that most nitrogen is deposited as wet ammonium (see Figure 16 of the *Air Resources and Climate Appendix*). The planning area has low nitrate and ammonium deposition compared to the rest of the United States (see Figure 18 of the *Air Resources and Climate Appendix*).

With regard to sulfur compound deposition, approximately 1.1 kg/ha-yr of sulfur compounds were deposited at Theodore Roosevelt National Park in 2006 (see Figure 17 in the *Air Resources and Climate Appendix*), with wet sulfates accounting for the largest sulfur contribution.

Mercury wet deposition in the planning area is not well characterized. A mercury monitoring station located in the Lostwood Wilderness in North Dakota indicates mercury deposition is less than 4 $\mu g/m^3$, which is low compared to most areas of the United States (see Figure 19 of the *Air Resources and Climate Appendix*).

Atmospheric deposition can also cause acidification of lakes and streams. One expression of lake acidification is the change in acid neutralizing capacity, the lake's capacity to resist acidification from atmospheric deposition. Acid neutralizing capacity is expressed in units of micro-equivalents per liter (μeq/L). Lakes with acid neutralizing capacity values of between 25 to 100 μeq/L are considered to be sensitive to atmospheric deposition, those with values of between 10 to 25 μeq/L are considered to be very sensitive, and those with values of less than 10 are considered to be extremely sensitive (Fox et al. 1989).

Visibility

Visibility is a measure of how far and how well an observer can see a distant and varied scene. Pollutant particles in the atmosphere can impair scenic views, degrading the contrast, colors, and distance an observer is able to see. Light extinction is used as a measure of visibility and is calculated from the monitored components of fine particle mass (aerosols) and relative humidity. Light extinction is expressed in terms of deciviews, a measure for describing perceived changes in visibility. One deciview is defined as a change in visibility that is just perceptible to an average person, which is an approximate 10-percent change in light extinction. To estimate potential visibility impairment, monitored aerosol concentrations are used to estimate visibility conditions for each monitored day. Aerosol species affecting visual range include ammonium sulfate, ammonium nitrate, organic mass, elemental carbon, soil elements, and coarse mass.

Daily visibility values are ranked from clearest to haziest and divided into three categories to indicate the mean visibility for all days (average), the 20 percent of days with the clearest visibility (20 percent clearest), and the 20 percent of days with the worst visibility (20 percent haziest). Visibility can also be defined by standard visual range, which is the farthest distance at which an observer can see a black object viewed against the sky above the horizon; the larger the standard visual range, the cleaner the air. Since 1980, the IMPROVE network has measured visibility in national parks and wilderness areas. These are managed as high visual quality Class I and II areas under the federal visual resource management (VRM) program.

Three IMPROVE stations are located in the planning area, including one in the Fort Peck Indian Reservation, the Medicine Lake National Wildlife Refuge, and the Northern Cheyenne Indian Reservation. Three more IMPROVE stations are located near the planning area, including Theodore Roosevelt National Park (North Dakota), the North Absaroka Wilderness (Wyoming), and Yellowstone National Park (Wyoming).

The average standard visible range at the Fort Peck Indian Reservation IMPROVE monitor was 44 miles during the average haziest 20 percent of days and 135 miles during the clearest 20 percent of days. Similar standard visual range data are 58 to 171 miles at the Northern Cheyenne Indian reservation and 42 to 133 miles at the Medicine Lake Wilderness. Outside the planning area, nearby data indicate visual ranges of 57 to 168 miles at the UL Bend National Wildlife Refuge, 36 to 107 miles at Theodore Roosevelt National Park, and 76 to 182 miles at Yellowstone National Park.

Trends

Deposition

Precipitation pH trends are not discernible at the Little Bighorn Battlefield National Monument, Poplar River, Theodore Roosevelt National Park, and Glacier National Park (see Figures 14 and 15 in the *Air Resources Appendix).*

Nitrogen and sulfur deposition at Theodore Roosevelt National Park was variable between 1999 and 2006 (see Figures 26 and 27 in the *Air Resources and Climate Appendix*).

Visibility

Visibility has remained relatively constant over the last 6 to 10 years in the planning area and nearby areas. Standard visual range trends are illustrated for four IMPROVE stations in Figures 24 through 27 of the *Air Resources and Climate Appendix*. From 1996 through 2006, visibility on the 20 percent worst visibility days remained constant at all Montana, Wyoming, and North and South Dakota monitors, except for a slight increase in haze (orange arrow) in the Gates of the Mountains Wilderness and a slight decrease in haze (blue arrow) in Yellowstone National Park (Figure 3-6). When the 20 percent best visibility days are considered, haze decreased throughout eastern Montana, the western Dakotas, and Wyoming while remaining relatively constant or decreasing slightly in western Montana.

SMOKE MANAGEMENT

Smoke management indicators include concentrations of CO and particulate matter.

Current Conditions

The MDEQ regulates prescribed fire activity under the authority of the Montana Open Burning Regulations (ARM Title 17, Section 8, Subchapter 6). The MDEQ issues open burn permits and, along with several counties, operates a Major and Minor Open Burning Smoke Management Program under the authority of MDEQ's Open Burning Regulations. In cooperation with the MDEQ, smoke management for prescribed fire activity is managed by the Montana/Idaho Airshed Group. Prescribed burns would be completed in a manner that is consistent with procedures established by the Montana/Idaho Airshed Group and the associated permit conditions of the Major Open Burning Permit and the rules addressing Minor Open Burning pursuant to the MDEQ Open Burning Regulations.

Average annual prescribed burn acres for Airshed 10 are approximately 3,850 acres. The BLM, MDEQ, and other federal land management agencies participate in the Montana/Idaho Interagency Smoke Management Coordination Strategy (more information is available at http://www.smokemu.org/). The planning area is contained in Airsheds 9 and 10.

Trends

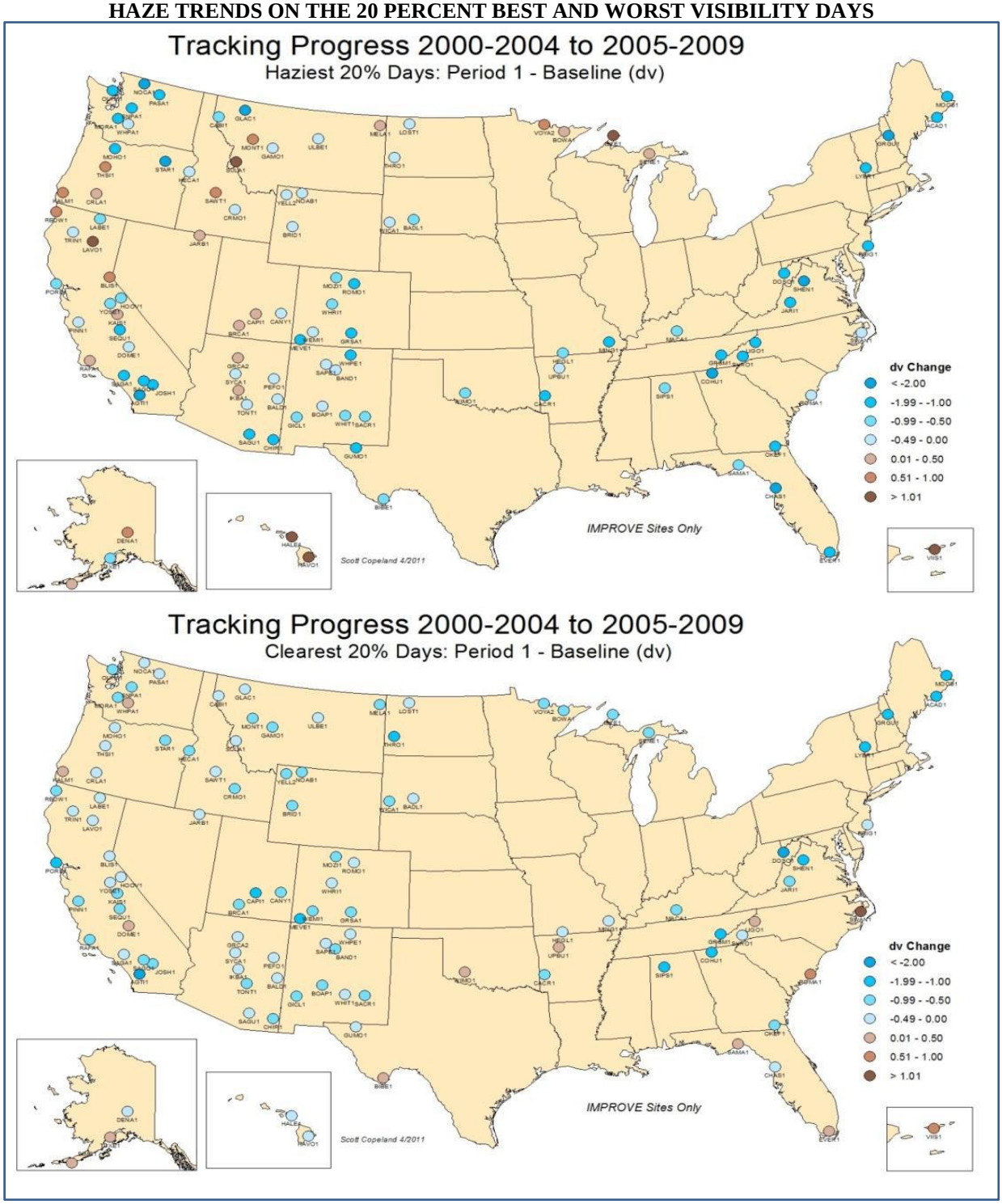
Smoke management remained approximately the same in the planning area from 2005 to 2012.

NOISE

Noise is unwanted sound. Sound-measurement equipment has been designed to adjust the actual sound pressure to correspond with human hearing. A-weighted correction factors deemphasize the very low and very high frequencies of sound in a manner similar to the response of the human ear. Therefore, the A-weighted decibel (dBA) is a good correlation to a human's subjective reaction to noise. The dBA measurement is based on a logarithmic scale of sound pressure. Assuming 60 dBA is the noise level experienced in normal conversation with two people standing 5 feet apart, a noise of 50 dBA would be half as loud, and a noise of 70 dBA would be twice as loud. For humans, a change in sound level of 3 dBA is generally just noticeable when the intruding noise is of a similar character to the background noise (e.g., an increase in existing traffic noise), and a change

of 5 dBA would clearly be noticeable. However, when the intruding noise is of a different character than the background noise (e.g., a motorcycle within existing car traffic), a noise level less than 1 dBA may be discernible.

FIGURE 3-6.
HAZE TRENDS ON THE 20 PERCENT BEST AND WORST VISIBILITY DAYS



Source: Hand et al. 2011

SOILS

Soils are the foundation of terrestrial ecosystems. This foundation depends on the soil potential and soil productivity, which in turn provides for the quality of ecosystem services. Consequently, maintaining soil resilience is fundamental for ecosystem recovery from disturbance (natural or anthropogenic).

Over time, topography and land management, through the actions climate and biota exert on parent material, further alter soil characteristics. Such soil-forming factors are variable across the planning area, resulting in dynamic soils with diverse physical and chemical properties.

Soils in the planning area have generally developed from sedimentary parent material (sandstone, siltstone, limestone, and shale) from the Fort Union formation. Soil textures range from very gravelly to clays. The planning area is characterized by gently rolling hills interrupted by scoria ridges, rugged badlands, buttes, and the breaks of major rivers. Soils are commonly calcareous, poorly developed, and contain few coarse fragments.

When the BLM authorizes surface disturbing activities in the planning area, mitigation is applied to conserve the soil resource. Within 2 to 5 years of the application of this mitigation, vegetative cover and rates of erosion have returned to pre-disturbance conditions (BLM 2008g). However, in some instances disturbance of sensitive soils has resulted in perpetually altered vegetation and erosion rates.

MAJOR LAND RESOURCE AREAS

The planning area's soils fall into two principal Major Land Resource Area (MLRA) units. The following soil descriptions of two major MLRA units are from the Natural Resources Conservation Service (NRCS) Handbook 296 (2006).

> Northern rolling high plains-northern part (58A). This is the dominant MLRA unit within the planning area (73 percent of the planning area). Tertiary continental shale, siltstone, and sandstone underlie the eastern one-third to one-half of this area, while marine and continental sediments underlie the rest of the MLRA, generally at the higher elevations. Although wide belts of steeply sloping badlands border a few of the larger river valleys, slopes are generally gently rolling to steep.
>
> Pierre shale plains-northern part (60B). This is the next dominant MLRA unit in the planning area (18 percent of the planning area). Marine and continental sediments underlie most of this MLRA. The shale plains have long, smooth, gentle to strong slopes.

The rest of the planning area contains the Pierre shale plains-60A (3 percent of the planning area), northern dark brown glaciated plains-53A (2 percent of the planning area), northern rolling high plains-southern part-58B (2 percent of the planning area), northern rolling high plains-eastern part-58D (1 percent of the planning area), rolling soft shale plains-54 (0.5 percent of the planning area), and brown glaciated plains-52 (0.5 percent of the planning area).

PROPOSED CARTER MASTER LEASING PLAN AREA

An area in Carter County has been identified for an oil and gas master leasing plan (MLP) (see *Oil and Gas* for more information on MLPs).

Soils within the Carter MLP area are highly variable. Soils in the area generally developed from the Pierre formation. Ecological sites are typically saline uplands or clayey (MLRA 60B, 10 to 14 inches precipitation zone). Terrain within the MLP area varies, and slopes reach up to approximately 200 percent. Approximately 0.9 percent (approximately 850 acres) of BLM-administered surface lands have 25 percent slopes or greater. Approximately 67 percent (approximately 93,000 acres) of BLM-administered surface lands are considered poorly suited to reclamation while about 2 percent (approximately 3,200 acres) potentially contain hydric soils.

CLIMATE CHANGE

Soils can be either a source or a sink for the GSGs CO_2, CH_4, and N_2O. Such gases are commonly produced by the decomposition of soil organic matter. Carbon dioxide (CO_2) and N_2O are produced by the respiration of soil biota and the oxidation of aerated organic matter. Methane (CH_4) is respired by bacteria in flooded soils and metabolized by bacteria in aerated soils.

The amount of organic carbon in soils is variable and localized, and is dependent on additions from organic matter and removal by decomposition, fire, and erosion. However, soils can store a finite amount of carbon.

Although much research is being conducted on carbon storage in soils, there is insufficient information available to estimate existing carbon stocks and storage potential within the planning area.

IMPORTANT SOIL CHARACTERISTICS

Soils sensitive to disturbances occur within the planning area (Table 3-7); these soils would be difficult to reclaim following degradation. Criteria used to determine soil sensitivity to surface uses is continually adapted as conditions change or new information or technology becomes available. The following site characteristics are considered to be at high risk of degradation from disturbance: soils poorly suited to reclamation, soils on steep slopes, highly compactable soils, and hydric soils.

TABLE 3-7.
SENSITIVE SOIL
RESOURCES IN THE PLANNING AREA

Soil Classification	Acres in the Planning Area[1]
Sensitive Soils	1,639,000
Hydric Soils	106,000
Soils with Poor Reclamation Suitability	1,549,000
Slopes 25 percent or Greater	154,000
Highly Erodible Soils in the Big Dry RMP Area	159,000
Slopes greater than 15 percent in the Big Dry RMP Area	284,000
Slopes 30 percent or Greater	90,000
Slopes 40 percent or Greater in the Big Dry RMP Area	15,000

[1]Acre figures may overlap, and adding these figures will not result in accurate total acreage values.

Reclamation suitability describes the ability of the soil resource to restore functional and structural integrity following disturbance. The rate and degree of recovery is dependent on the action, time of year, and various site characteristics. Soils poorly suited to successful reclamation contain characteristics that include high salt content, limited precipitation, poor water-holding capacity, inadequate rooting depth, or highly erosive qualities.

The planning area contains naturally erosive soils. Key factors used to determine erodibility within the planning area are percent slope, soil erodibility factor values (Kw), and wind erodibility index values. The Kw factor expresses the effects of sheet and rill erosion and is determined by soil characteristics that include texture, rock fragments, organic matter, structure, and saturated hydraulic conductivity. Texture, clod composition, organic matter, rock fragments, and calcium carbonate determine the wind erodibility index. Disturbances that remove vegetation and other ground cover result in soil loss beyond natural rates (accelerated erosion); the loss of

topsoil and nutrients degrades site productivity.

DATA SOURCES

Soils within the planning area have been mapped and interpreted for land use and the information is available by county from the NRCS (2009b) through the Soil Survey Geographic Database. This database is used for site-specific evaluations, although on-site evaluations may also be recommended. Soil Survey Geographic Database Ecological Site Descriptions are often used to evaluate site potential. Field observations and previous National Environmental Policy Act (NEPA) analyses may be used in site-specific evaluations. Rangeland health and proper functioning condition (PFC) assessments are commonly used to evaluate soil health (see the *Vegetation Appendix*). General soil information can be found in the United States General Soil Map Database for Montana, known as STATSGO2, also provided by the NRCS.

WATER RESOURCES

Water resources across the planning area are present as surface water (e.g., rivers, streams, creeks, coulees, springs, reservoirs, lakes, ponds, wetlands, and canals) and groundwater from a variety of geologic strata. Water resources are essential to the residents of eastern Montana to support agriculture, public water supplies, industry, and recreation. Water resources, wetlands, and riparian health are crucial to the survival of numerous migratory bird species and BLM-designated sensitive birds, fish, reptiles, and amphibians.

WATERSHED CONDITION

The planning area is located within the Upper Missouri River basin of the Missouri River Hydrologic Region. Hydrologic subbasins in the planning area, defined by the USGS National Hydrography Dataset (i.e., 4th order watershed), include the Beaver, Big Porcupine, Boxelder, Brush Lake, Charlie-Little Muddy, Fort Peck Reservoir, Little Dry, Little Powder, Lower Belle Fourche, Lower Musselshell, Lower Powder, Lower Tongue, Lower Yellowstone, Lower Yellowstone-Sunday, Middle Little Missouri, Middle Musselshell, Middle Powder, Mizpah, O'Fallon, Poplar, Porcupine, Prairie Elk-Wolf, Redwater, Rosebud, Upper Little Missouri, Upper Tongue, and the West Fork Poplar watersheds.

Watershed condition is determined by the physical and biological characteristics and processes that impact the function of a watershed. Watershed functionality includes hydrologic and ecologic functions (such as collection and transportation of precipitation and water storage and release) and characteristics (such as sites for plant and animal habitat and chemical reactions). Properly functioning or "healthy" watersheds have high biotic and soil integrity and connectivity, are resilient to disturbance, maintain water quality and quantity, recharge aquifers, and maintain riparian communities (Potyondy 2010).

Disturbance in upland areas impact watershed hydrology by causing the removal of vegetation, exposing the soil to erosion, and contributing to soil compaction. Vegetation condition influences the quantity and quality of water within the watershed. Healthy vegetation communities provide ground cover, which facilitates infiltration, reduces overland and peak flows, and maintains base flows (WDFG 2010a).

Soil erosion affects water quality. Erosion introduces metals, salts, chemicals, and nutrients (such as nitrogen, phosphorus, and sulfur) to water. Soil erosion can cause eutrophication in addition to altering water chemistry, increasing sedimentation, and increasing increased total dissolved solids (TDS). Fertilizer application, livestock grazing, feedlots, septic tanks, atmospheric deposition, and the release of sewage to water can also cause eutrophication. Eutrophication (high plant productivity and increased biomass of algae and other aquatic plants) is often caused by increases in nutrient levels, which can cause decreased water clarity, increased TDS, alteration of food webs, lower dissolved oxygen, higher pH, changes in community composition, and channel flow impediments. Algae blooms can contribute to taste and odor problems for drinking water and can be toxic to aquatic life or humans.

SURFACE WATER

Surface water in the planning area is capable of supporting a variety of beneficial uses (Table 3-8). Surface water is the primary source for all water use in Montana, representing 97 percent (Kenny et al. 2009). Most of the planning area is sparsely settled and land use consists primarily of family and cooperative ranches, coal mining, and oil and gas development. Irrigation is the predominate use of surface water, composing approximately 95 percent of the total surface water withdrawn. Thermoelectric power production (2.9 percent), livestock use (0.4 percent), public water supply (0.9 percent), industrial (0.4 percent), mining (0.2 percent), domestic water (less than 0.01 percent), and aquaculture (less than 0.01 percent) account for the remaining surface water use in the planning area (USGS 2005).

The Missouri and Yellowstone rivers are the largest rivers in the planning area, draining 91,557 and 69,083 square miles respectively (Table 3-9). The Missouri River flows to the east and drains the northern portion of the planning area, with an average annual discharge of 7,272,000 acre-feet per year near Culbertson, Montana (USGS 2009a). The planning area includes the portion of the Missouri River located directly below Fort Peck Reservoir and east to the North Dakota border. Major tributaries of the Missouri River include the Big Dry and Box Elder creeks and the Little Missouri, Musselshell, Poplar, and Redwater rivers. Flowing northeast to the Missouri River, the Yellowstone River drains the southern and eastern portion of the planning area with an average annual discharge of 8,557,000 acre-feet per year near Sidney, Montana (USGS 2009b). Major tributaries of the Yellowstone River include the Rosebud, Otter, Armells, Hanging Woman, Mizpah, and O'Fallon creeks and the Little Powder, Powder, and Tongue rivers.

According to the USGS National Hydrography Dataset, approximately 121,000 miles of streams and rivers are located within the planning area. Of these, approximately 13,000 miles (11 percent) of streams and rivers flow across BLM-administered lands. Perennial streams retain water year round and flow regimes are variable and subject to meteorological conditions. Intermittent streams do not flow year round. Discharge occurs during periods of sufficient input of groundwater or surface water sources such as snowmelt or rainstorms. Typically, ephemeral (which flow only in direct response to precipitation) and intermittent streams conduct water to perennial streams. More than 97 percent of stream miles in the planning area are intermittent and ephemeral.

Intermittent and ephemeral streams play an important role in the hydrologic function of the ecosystems of the planning area by transporting water, sediment, nutrients, and debris through the stream network and providing connectivity within a watershed. These streams filter sediment, dissipate energy from snowmelt and storm water runoff, facilitate infiltration, and recharge groundwater (Levick et al. 2008). The pools within intermittent streams retain water in the dry months, supporting riparian vegetation and providing water resources for wildlife and livestock.

A number of factors (including streamflow regime, topography, geology, soils, vegetation, climate, and land use history) influence stream morphology. Stream conditions on BLM-administered land within the planning area reflect a number of historical and current impacts, such as agriculture, mining, and oil and gas development. Tertiary bedrock (sandstones, siltstones, shales, and scoria), alluvium, and glacial till represent the surface geology in the planning area. This parent material tends to form highly erosive fine-grained soils (loams to silt loam). Streambeds typically consist of sand and silt, with few bedrock channels. Since streambeds and streambanks generally lack control features (e.g., rocks, cobbles, and bedrock), stream morphology and stability is highly influenced by the presence and type of riparian vegetation. These systems have high levels of natural instability and rapid degradation can occur from human disturbance (Elmore and Kauffman 1994). The potential for invasion by nonnative species is increased when development alters physical conditions (i.e., stabilizes flow regimes or reduces sediment loads) (WDFG 2010a).

TABLE 3-8.
2005 SURFACE WATER WITHDRAWALS FOR COUNTIES IN THE PLANNING AREA

County	Millions of Gallons per Day								
	Public Supply	**Domestic**	**Industrial**	**Irrigation**	**Livestock**	**Aquaculture**	**Mining**	**Thermoelectric**	**Total**
Big Horn	0.84	0.00	0.00	267.34	0.28	0.00	2.67	0.00	**271.13**
Carter	0.00	0.01	0.00	8.37	0.89	0.00	0.23	0.00	**9.50**
Custer	1.38	0.00	0.00	117.87	1.10	0.01	0.01	0.00	**120.37**
Daniels	0.00	0.00	0.00	1.62	0.00	0.00	0.00	0.00	**1.62**
Dawson	1.52	0.00	0.00	50.36	0.51	0.00	0.00	0.00	**52.39**
Fallon	0.00	0.00	0.00	0.24	0.64	0.00	0.00	0.00	**0.88**
Garfield	0.00	0.00	0.00	14.50	0.76	0.00	0.00	0.00	**15.26**
McCone	0.00	0.00	0.00	25.80	0.19	0.00	0.00	0.00	**25.99**
Powder River	0.00	0.00	0.00	38.58	0.07	0.00	0.00	0.00	**38.65**
Prairie	0.00	0.00	0.00	52.39	0.36	0.00	0.00	0.00	**52.75**
Richland	0.00	0.00	0.87	349.47	0.82	0.00	0.08	20.07	**371.31**
Roosevelt	0.11	0.00	0.00	89.54	0.40	0.00	0.00	0.00	**90.05**
Rosebud	0.68	0.00	0.00	210.94	0.82	0.00	2.03	27.80	**242.27**
Sheridan	0.05	0.00	0.00	3.44	0.32	0.00	0.00	0.00	**3.81**
Treasure	0.14	0.00	0.00	71.07	0.36	0.00	0.00	0.00	**71.57**
Valley	1.00	0.02	0.00	229.64	0.81	0.00	0.05	0.00	**231.52**
Wibaux	0.00	0.00	0.00	1.80	0.22	0.00	0.03	0.00	**2.05**
Total	**5.72**	**0.03**	**.87**	**1532.97**	**9.31**	**0.01**	**5.10**	**47.87**	**1601.12**

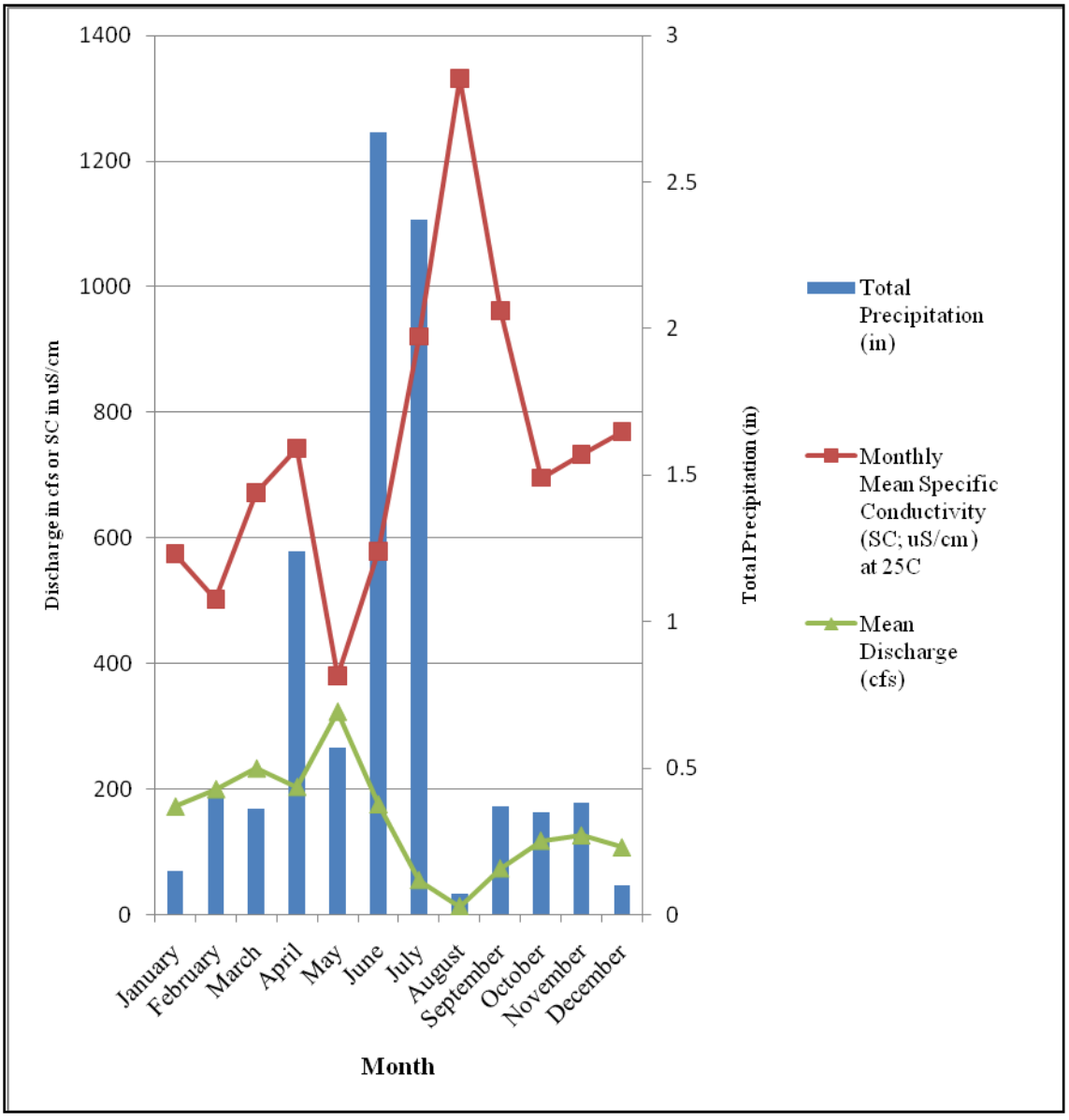
Source: USGS 2005. Portions of the Fort Peck Reservoir, Porcupine, Upper Tongue, Rosebud, Lower Yellowstone-Sunday, and West Fork Poplar watersheds occur outside of the planning area.

TABLE 3-9.
RIVERS AND STREAMS IN THE PLANNING AREA BY SUBBASIN

HUC	Subbasin	Total Stream Miles (BLM-administered land)	Total Stream Miles	Subbasin Area within the Planning Area (mi^2)
Subbasins Draining to the Missouri River				
10110204	Beaver	6	1,050	461
10040105	Big Dry	564	4,654	1,547
10060006	Big Muddy	4	5,514	2,471
10110202	Box Elder	836	3,400	1,145
10060007	Brush Lake Closed	0	122	277
10060005	Charlie-Little Muddy	193	3,332	1,162
10040104	Fort Peck Reservoir	1,537	6,288	2,086
10040106	Little Dry	277	3,437	1,222
10120202	Lower Belle Fourche	156	305	83
10050012	Lower Milk	0	210	80
10040205	Lower Musselshell	445	2,229	706
10110203	Middle Little Missouri	27	201	72
10040202	Middle Musselshell	63	1,529	396
10060003	Poplar	<1	3,696	1,293
10050016	Porcupine	0	1,187	340
10060001	Prairie Elk-Wolf	611	6,233	1,950
10060002	Redwater	161	7,836	2,113
10110201	Upper Little Missouri	959	5,270	1,759
10060004	West Fork Poplar	0	1,507	573
Subbasins Draining to the Yellowstone River				
10100002	Big Porcupine	257	3,184	872
10090208	Little Powder	269	1,997	652
10080015	Lower Bighorn	0	393	122
10090209	Lower Powder	1,333	5,653	1,876
10090102	Lower Tongue	513	8,873	2,871
10100001	Lower Yellowstone-	1,251	14,593	4,534
10100004	Lower Yellowstone	1,796	14,141	4,577
10090207	Middle Powder	415	2,057	714
10090210	Mizpah	189	2,407	803
10100005	O' Fallon	599	4,237	1,578
10100003	Rosebud	82	3,303	1,138
10090101	Upper Tongue	194	2,526	831
	Total	**12,738**	**121,364**	**40,304**

The planning area climate is semi-arid to arid. The majority of the planning area receives less than 15 inches of precipitation annually. Typically, high runoff from snowmelt causes the highest streamflow across the planning area from May to June. Intense summer storms contribute to moderate flow rates that continue into July. The Tongue River near Decker, Montana, illustrates this typical annual flow pattern (Figure 3-7).

FIGURE 3-7.
2001 MEAN MONTHLY FLOW AND PRECIPITATION VERSUS ELECTRICAL CONDUCTIVITY FOR THE TONGUE RIVER NEAR DECKER, MONTANA



Generally, there is an inverse relationship between in-stream flow (discharge) and salinity concentrations (electrical conductivity [EC]). EC is the ease with which electric current will pass through a water sample, and is proportional to the salinity of the sample (microSiemens per centimeter [µS/cm]). During the winter, in-stream flow rates are relatively low and salinity concentrations and sodium adsorption ratios (SAR) are high because stream flow is fed by saline groundwater with a higher SAR (base flow). Because groundwater is in contact with soil and bedrock for extended periods, it contains higher concentrations of dissolved solids (ions

such as chloride, sodium, potassium, calcium, magnesium, sulfate, and bicarbonate) than meteoric water (snowmelt) and therefore has a higher EC. Conversely, during periods of heavy overland flow (May, June, and July), the groundwater contribution (base flow) is diluted by precipitation while meteoric water and salinity values are lower.

The variability of surface water quality presents challenges to water users, specifically irrigators, since irrigation with saline water results in reduced crop yield (Hill and Koenig 1999). Higher sodium concentrations (sodic) are of concern in the Powder River and Mizpah Creek drainages. Irrigation with sodic water can adversely affect crop growth (by creating calcium, potassium, and magnesium deficiencies) and affect the physical properties of soils by promoting crusting and impeding drainage in soils containing large amounts of clay.

The planning area contains approximately 40,000 known lakes, reservoirs, and ponds; 3,300 (8 percent) are located on BLM-administered lands within the planning area and support beneficial uses including irrigation, stock water, recreation, fisheries, and wildlife. The majority of these features consist of small ponds and impoundments (less than 1 acre) built across intermittent streams to capture spring runoff for stock use during the summer months (Table 3-10). There are numerous undocumented stock ponds, dugouts, and small impoundments across the planning area.

TABLE 3-10.
SIZE AND SUMMARY OF WATERBODIES IN THE PLANNING AREA

Size (acres)	Number of Waterbodies (BLM-administered land)	Percentage (%) of Waterbodies (BLM-administered land)	Number of Waterbodies	Percentage (%) of Waterbodies
Less than 1	1,784	54.1	26,206	65.5
1 to 1.9	629	19.1	6,292	15.7
2 to 4.9	581	17.6	4,825	12.1
5 to 9.9	175	5.3	1,626	4.1
More than 10	127	3.9	1,055	2.6

Surface water impoundments have altered the natural hydrologic regime of streams and rivers by reducing streamflow, dissolved oxygen, and floodplain size and extent downstream (Vorosmarty 2000); increasing infiltration to groundwater, scour of the downstream streambed, and water temperature (Dodds 2004); substantially increasing evaporative losses; degrading water quality; and changing nutrient cycling, timing, and magnitude of peak and low flows, sediment load, and riparian vegetation recruitment and succession.

According to the USGS National Hydrography Dataset, there are 1,920 known springs and seeps in the planning area (80 of which are on BLM-administered lands) and numerous undocumented springs. Springs are important for aquatic habitat, biodiversity support; sustained streamflow, wetland and riparian vegetation community support, and as a water source for livestock, wildlife, or drinking.

The planning area contains approximately 1.4 million acres of 100-year floodplains, of which 42,000 occur on BLM-administered surface acres and 330,000 on BLM-administered mineral estate acres. Floodplain function is essential to watershed function, water quality, soil development, stream morphology, and wetland and riparian community composition (Scott 1997). Floodplains reduce flood peaks and velocities, thereby reducing erosion; enhancing nutrient cycling; reducing frequency and duration of low flows; and increasing infiltration, water storage, and aquifer recharge. Floodplains enhance water quality by facilitating sedimentation and filtering

overland flow. Floodplains support high plant productivity, high biodiversity, and habitat for wildlife. Hydrologic modification via water diversions, dams, and channelization have altered the natural flooding regime across the planning area and reduced or eliminated floodplain functionality.

Hydrologic modification and channelization, in addition to other factors, have led to a decline in riparian forests across the Great Plains, in particular cottonwood species (*Populus sp.*). Cottonwood communities reduce sedimentation and floodwater velocity and provide critical erosion control, large woody debris input, thermal cover, and streambank stability (Hansen 2008). Periodic flooding is essential to riparian communities of active floodplains (Eubanks 2004). In particular, plains cottonwood (*Populus deltoides*) recruitment is dependent on flood scour and the maintenance of the historical magnitude, frequency, and duration of floods of a recurrence interval of 9.3 years or greater (Scott 1997).

WATER QUALITY

Surface water and groundwater quality can be affected by point or nonpoint source pollution. Point source pollution originates from a discernible, confined, and discrete conveyance from which pollutants are discharged. It is regulated by the State under the Montana Pollution Discharge Elimination System. Common sources are concentrated animal feeding operations, construction, mining, and industrial activity. Nonpoint source pollution is Montana's largest source of water quality impairment. Nonpoint source pollution originates from diffuse sources of contamination and is transported to waterbodies through precipitation, infiltration, and overland flow. Common sources are land use activities such as agriculture, forestry, urban development, and mining. Common contaminants from nonpoint source pollution are sediment, nutrients, temperature, heavy metals, pesticides, pathogens, and salt. Wetlands and riparian areas in PFC can significantly reduce the impacts of nonpoint source pollution by buffering adjacent waterbodies (MDEQ 2007).

The MDEQ *Montana Nonpoint Source Management Plan* outlines nonpoint source pollution problems and establishes goals, objectives, and strategies for controlling nonpoint source pollution on a statewide basis (MDEQ 2012). The goal of the *Montana Nonpoint Source Management Program* is to provide a clean and healthy environment by protecting and restoring water quality from the harmful effects of nonpoint source pollution. As a component of the Montana Nonpoint Source Program, the BLM and MDEQ developed a memorandum of understanding (MOU) regarding Water Quality Management on BLM lands in Montana to cooperatively manage and control nonpoint source pollution from BLM-administered lands and authorizations (BLM and MDEQ 2010). Under the MOU, the BLM will work to reduce nonpoint source pollution and improve water quality, watershed health, and riparian health on BLM-administered lands. The MOU also provides the mechanism for ensuring project consistency with the State's Nonpoint Source Management Program (BLM and MDEQ 2010).

As waterbodies are assessed by the MDEQ for water quality, they are classified into Water Quality Categories (see the *Water Appendix*). When water quality monitoring data reveal that a waterbody does not attain water quality standards, the water is considered impaired (does not meet standards), or threatened (is likely to violate standards in the near future). More precisely, the specific beneficial use is, or will, become impaired. Under the requirements of Sections 208 and 303(e) of the Clean Water Act, any water found to have one or more threatened or impaired uses must be placed on a list (303(d)) for which water quality management plans must be developed to correct the cause of the identified impairments. In cases where the impairment involves the need to reduce the load (amount or concentration) of specific pollutants in the water, the water quality management planning process must include the determination of a total maximum daily load (TMDL) for each pollutant exceeding the standard. The planning area includes all or portions of 14 TMDL planning areas in various TMDL development stages (see the *Water Appendix*). The MDEQ has determined that no TMDLs are required to be submitted to the USEPA for the Lower Musselshell TMDL Planning Area but has approved a Water Quality Restoration Plan (MDEQ 2001). The MDEQ has finalized the *Redwater River Nutrient and Salinity TMDLs and Framework Water Quality Improvement Plan* that addresses nutrient- and salinity-listed waters but not sediment-listed waters (MDEQ 2010a).

In the planning area, 65 waterbodies were listed as impaired in the MDEQ's 2012 *Final Water Quality Integrated Report*. Out of 5,500 total miles of rivers and streams, 640 miles (12 percent) fully support all beneficial uses and 3,850 miles (70 percent) are impaired or threatened. There are four lakes and reservoirs

within the planning area on the impaired or threatened list totaling 136,000 acres (out of five total reservoirs, 99 percent of the total acres). A 2012 list of impaired and threatened waters within the planning area appears in the *Water Appendix*.

Out of 229 total miles of rivers and streams occurring on BLM-administered lands in the planning area, 39 miles (17 percent) fully support all beneficial uses and 127 miles (55 percent) are impaired or threatened. The Tongue River Reservoir (5 acres) is the only impaired reservoir or lake occurring on BLM-administered land in the planning area.

Waterbodies, for which one or more beneficial uses are impaired or threatened, and a TMDL is required to address the factors causing the impairment or threat are listed on the 303(d) list. This list is a subset of all waterbodies listed on the comprehensive 2012 *Final Water Quality Integrated Report.* Within the planning area, there are 3,230 miles of rivers and streams on the 303(d) list (59 percent of the total miles) (see Table 2 in the *Water Appendix*). Of these, 110 miles occur on BLM-administered land. There are four lakes and reservoirs (totaling 136,000 acres) on this list (out of 5 total reservoirs; 99 percent of the total acres) (see Table 3 in the *Water Appendix*). Of these, 5 acres occur on BLM-administered land. There was no change in the number of waterbodies, stream miles, or waterbody acres listed on the *Final Water Quality Integrated Report* within the planning area between 2010 and 2012.

Impaired and threatened waterbodies fail to support one or more beneficial uses under a number of parameters. The most common causes of water impairment are phosphorus, alteration in stream-side or littoral vegetative covers, iron, and total nitrogen. The most common probable sources of impairment in the planning area are natural sources; unknown sources; agriculture, including irrigated crop production; grazing; and hydrostructure and flow alterations (see Table 2 in the *Water Appendix*) (MDEQ 2012).

The Northern Cheyenne Tribe adopted surface water quality standards in 2001. The Northern Cheyenne Tribe has been granted "Treatment as a State" status by the USEPA and the USEPA approved their standards in March 2013, with no action taken on the EC and SAR criteria. As such, the Northern Cheyenne numerical standards have standing under the Clean Water Act with the exception of EC and SAR. These standards outline the Tribes considered determination of the water quality needed to protect irrigated agriculture on the Reservation and native plant species with cultural significance integral in ceremonial and traditional areas. Therefore, the Northern Cheyenne standards provide reasonable criteria against which to compare the resulting water quality. The Northern Cheyenne's non-degradation criteria apply to all numerical standards (non-degradation criteria do not apply in-stream, but rather serve as a trigger during the permitting process).

GROUNDWATER

Within the planning area, useable aquifers occur at various depths. These resources are valuable for residents and may be the only water source available in some parts of the planning area. Although groundwater represents less than 3 percent of the total water use in the state (Solley, Pierce, and Perlman 1998), it is extremely important because it provides almost 100 percent of the domestic water used by farmsteads and constitutes the largest percentage of dependable stock water (Table 3-11). Irrigation is the predominate use of groundwater, composing 64.0 percent of the total groundwater withdrawn. Public water supply (12.5 percent), livestock use (9.9 percent), domestic water (7.0 percent), mining (4.4 percent), industrial (2.0 percent), thermoelectric power production (0.2 percent), and aquaculture (less than 0.01 percent) account for the remaining groundwater use in the planning area (USGS 2005). According to the Montana Bureau of Mines and Geology (MBMG) in 2009, there were approximately 37,000 groundwater wells across eastern Montana (Carter, Powder River, Rosebud, Treasure, Custer, Fallon, Wibaux, Prairie, Garfield, McCone, Dawson, Richland, Valley, Roosevelt, Daniels, and Sheridan counties) (MBMG 2009). See the *Water Appendix* for more information regarding groundwater well aquifer use by county.

The planning area is within the Northern Great Plains regional aquifer system, which is one of the largest confined aquifer systems of the United States. This aquifer system comprises primarily Tertiary and Cretaceous sandstone aquifers, Paleozoic carbonate aquifers, and confining units that can be discontinuous locally, but which function as a single aquifer. This regional aquifer system underlies part of North Dakota, South Dakota,

TABLE 3-11.
2005 GROUNDWATER WITHDRAWALS FOR COUNTIES IN THE PLANNING AREA

County	Millions of Gallons per Day								
	Public Supply	Domestic	Industrial	Irrigation	Livestock	Aquaculture	Mining	Thermo-electric	Total
Big Horn	0.27	0.52	0.01	4.12	1.10	0.00	1.83	0.00	7.85
Carter	0.08	0.06	0.00	1.06	0.04	0.00	0.04	0.00	1.28
Custer	0.01	0.18	0.04	0.80	0.25	0.01	0.00	0.00	1.29
Daniels	0.21	0.06	0.03	0.88	0.25	0.00	0.00	0.00	1.43
Dawson	0.61	0.17	0.05	0.25	0.20	0.00	0.26	0.00	1.54
Fallon	0.41	0.07	0.04	0.71	0.01	0.00	0.03	0.00	1.27
Garfield	0.04	0.07	0.00	0.36	0.26	0.00	0.00	0.00	0.73
McCone	0.09	0.09	0.03	0.01	0.35	0.00	0.00	0.00	0.57
Powder River	0.14	0.10	0.00	0.17	0.85	0.00	0.00	0.00	1.26
Prairie	0.01	0.08	0.00	1.11	0.16	0.00	0.00	0.00	1.36
Richland	1.09	0.27	0.01	1.67	0.18	0.00	0.00	0.00	3.22
Roosevelt	0.44	0.42	0.04	2.20	0.10	0.00	0.01	0.00	3.21
Rosebud	0.71	0.09	0.08	1.27	0.36	0.00	0.09	0.10	2.70
Sheridan	0.31	0.09	0.06	9.28	0.10	0.00	0.11	0.00	9.95
Treasure	0.00	0.03	0.00	0.92	0.01	0.00	0.00	0.00	0.96
Valley	0.34	0.09	0.11	4.14	0.45	0.00	0.01	0.00	5.14
Wibaux	0.06	0.03	0.00	0.03	0.11	0.00	0.00	0.00	0.23
Total	**4.82**	**2.42**	**.464**	**28.98**	**4.88**	**0.01**	**2.38**	**0.10**	**44.0**

Source: USGS 2005

Montana, Wyoming, and Canada. Unconsolidated glacial and alluvial deposits overlie the system, and low-yield, crystalline rocks underlie, the system. The regional flow paths trend southwest to northeast. Recharge occurs at high altitudes and travels down the dip of the aquifers before travelling upward to discharge into shallower aquifers or onto the land surface. Much of the water moves into and through the Powder River and the Williston structural basins (Miller 1999). Within the planning area, the primary bedrock aquifers occur in sandstones and coal beds composing the Tertiary Fort Union formation and sandstones composing the Cretaceous Hell Creek and Fox Hills formations.

Forty-four percent of the wells in eastern Montana access shallow aquifers less than 100 feet deep (Table 3-12 and Table 5 in the *Water Appendix*). Surficial aquifers within the planning area generally consist of Quaternary alluvium and undifferentiated Quaternary and Tertiary sediments (e.g., fluvial sand and gravel deposits, terrace gravels, and Flaxville formation gravels) (Zelt, Boughton, Miller, Mason, and Gianakos 1999). Water moves along local flow paths and typically discharges to streams and springs or recharges underlying regional aquifer systems (Miller 1999). Alluvial aquifers are among the most productive sources of groundwater within the planning area and occur in floodplains, terrace deposits, and along the channels of larger streams, tributaries, and rivers. They are typically 0 to 40 feet thick, but can attain thicknesses up to 250 feet.

Although the quality of groundwater from alluvial aquifers is generally good, it can be highly variable (approximately 100 to 2,800 mg/L TDS and specific conductance of 500 to 125,000 µS/cm, with SAR of 5 to 10). Wells completed in coarse sand and gravel alluvial aquifers can yield as much as 100 gallons per minute (gpm), although yields of 15 gpm are the average. Alluvial deposits associated with abandoned river channels or detached terraces, will usually only yield as much as 20 gpm because they are topographically isolated and have limited saturation (Zelt et al. 1999).

The primary lower Tertiary (Cenozoic) aquifers include the Wasatch and Fort Union formation sandstones, clinker deposits, and coal beds. The Lebo member of the Fort Union formation functions as a confining layer and may yield water locally in areas in which sufficient thicknesses of channel deposits occur (Zelt et al. 1999). Clinker zones, which have a high permeability, are spring sources. These burned coal beds are typically

TABLE 3-12.
GROUNDWATER WELLS BY TOTAL DEPTH IN EASTERN MONTANA

Depth (feet)	Number of Wells	Percentage of Total Wells (%)
0 to 99	16,644	44
100 to 199	9,526	25
200 to 299	4,136	11
300 to 399	1,948	5
400 to 499	953	3
500 to 599	597	2
600 to 699	380	1
700 to 799	296	<1
800 to 899	261	<1
900 to 999	210	<1
Greater than 1,000	547	2
Unknown	1,958	5

Source: MBMG 2009

unsaturated but form local aquifers where they occur below the water table. Overlying, fractured sandstones are a source of recharge (Miller 1999). The Wyodak and Wyodak Rider coal zone and the Anderson, Canyon, Big George, and Smith coals compose a regional aquifer with limited recharge at outcrops. The coal beds act as isolated aquifers and some flow occurs along faults and fractures (NAS 2010). Water within the lower Tertiary aquifers is commonly unconfined but can be confined by clay beds or glacial deposits. Flow trends northward and northeastward with discharge to the Yellowstone and Missouri rivers (Miller 1999). The Wasatch formation can be up to 1,000 feet thick (Miller 1999). Wells within the Fort Union formation aquifers are typically 100 to 200 feet deep but can be up to 1,500 feet in depth. These wells may produce as much as 40 gpm but yields of 15 gpm are more typical. In areas in which aquifers are confined and artesian conditions exist, wells in the Fort Union formation will generally flow less than 10 gpm.

The primary upper Cretaceous (Mesozoic) aquifers are the Cretaceous Hell Creek formation sandstones, Lance formation sandstones, and Fox Hills sandstone. The Lance and the Hell Creek formations range in thickness from approximately 350 to 3,400 feet and consist of interbedded sandstone, siltstone, claystone, coal, and lignite. The underlying Fox Hills sandstone ranges from approximately 300 to 450 feet thick. Flow trends north to northeast. Conditions are generally unconfined and aquifers discharge to major streams (Miller 1999). Well depths in Hell Creek and Fox Hills formation aquifers are highly variable but typically range from 200 to 1,000 feet in depth, with wells being shallowest immediately east of the Cedar Creek Anticline and in other areas where these formations crop out around the edges of the Williston and Powder River Basins. Groundwater yields from these aquifers may be as much as 200 gpm but are generally less than 100 gpm. Artesian wells within these aquifers may flow as high as 20 gpm (Zelt et al. 1999).

The lower Cretaceous-Jurassic (Mesozoic) aquifers are separated from the upper Cretaceous aquifers by the confining Pierre and Lewis shales. The principal aquifers are the Muddy sandstone, Newcastle sandstone, Inyan Kara Group, and the Fuson and Lakota formations. The Sundance, Swift, Rierdon, and Piper formations yield water locally to wells. Because of the overlying confining unit, the lower Cretaceous-Jurassic (Mesozoic) aquifers generally do not discharge to streams (except locally). Water quality ranges from 1,000 to over 10,000 mg/L TDS (Miller 1999).

Water wells are rarely completed in the upper and lower Paleozoic aquifers because they are deeply buried and contain little freshwater. Upper Paleozoic aquifers consist primarily of the Madison Limestone or Madison Group. Locally, flow trends inward from all directions toward potentiometric depressions in eastern Montana. The depressions are possibly the result of the production of oil and gas from deeper strata. Withdrawal of oil

and gas can allow water to leak downward from the upper Paleozoic aquifers through confining units (Miller 1999).

Groundwater yields from the deeper Paleozoic Madison formation aquifer can range from 1 to 100 gpm to even higher in karst areas (Noble, Bergantino, Patton, Sholes, Daniel, and Schofield 1982; Zelt et al. 1999). The well depth ranges from 500 to over 7,000 feet (BLM 2008g). Water quality of this aquifer is highly variable and TDS can be greater than 300,000 mg/L (Miller 1999). Lower Paleozoic aquifers consist of Ordovician to Cambrian sandstone and carbonate rocks. Flow trends generally move northeastward toward the deep parts of the Williston Basin, but some flow leaks upward and discharges to springs, lakes, and streams in eastern North Dakota. Water quality of this aquifer is highly variable and TDS can be greater than 100,000 mg/L (Miller 1999).

SOURCE WATER PROTECTION AREAS

The Safe Drinking Water Act Amendments of 1996 require states to develop and implement a Source Water Assessment Program that analyzes existing and potential threats to public water systems that receive supplies of drinking water. Public water systems are classified either as community water systems, non-transient non-community systems, or transient non-community systems. Community water systems typically provide service to incorporated towns, housing subdivisions, trailer courts, and other similar developed areas. Non-transient non-community systems do not serve communities but may provide service to schools, hospitals, and individual businesses. Transient non-community systems usually provide seasonal service and serve facilities in areas such as campgrounds, parks, rural motels, and cafes.

The USEPA formally accepted the MDEQ's Source Water Assessment Program in 1999. Since then it has completed Source Water Delineation and Assessment Reports for almost every public water system in the state. Each report delineates a Source Water Protection Area in which potential contaminant sources are inventoried and assigned a susceptibility rating. Management recommendations are made based on this susceptibility analysis in order to minimize the risk associated with potential threats to public water systems. There are 117 Source Water Protection Areas delineated within the planning area encompassing 110,000 acres. Of these public water systems, 9 utilize surface water sources including East Fork Armells Creek, the Missouri River, the Yellowstone River, and Fort Peck Reservoir; 108 public water systems utilize groundwater from underlying aquifers. Table 1 in the *Water Appendix*, provides a list of aquifers within the planning area and identifies which aquifers are known to be Sources of Underground Drinking Water.

WATER RIGHTS AND GROUNDWATER AQUIFER CONTROL AREAS

Water rights in Montana are subject to Montana's Water Use Act (85-2-101 et seq. Montana Code Annotated [MCA]) of 1973, which became effective July 1, 1973. Water rights existing prior to that date are finalized by state courts. Water rights applications submitted after that date will be evaluated through the Montana Department of Natural Resources and Conservation (MDNRC) permit system. In 2005, the Montana Legislature passed House Bill 22 to expedite water right claims examination and issuance of water right decrees and requires that the adjudication be completed by 2020.

Water rights on some BLM-administered lands are protected by the *Federally Reserved Water Rights for Public Springs and Water Holes, Public Water Reserve 107*, pursuant to the Executive Order dated April 17, 1926. Compacts between the State of Montana and the Northern Cheyenne Tribe have placed a moratorium on new water use developments on tribal lands within the Rosebud, Lower Bighorn, and Pryor watersheds. Water rights are adjudicated on an individual watershed basis. As of December 2010, Rosebud Creek and Yellowstone River (below the Powder River) were 78.43 and 41.1 percent examined, respectively (MDNRC 2010b). The Redwater River, Powder River (below Clear Creek), O'Fallon Creek, Little Missouri River (below Little Beaver Creek), Little Powder River, and Belle Fourche River (above the Cheyenne River) have been issued a final decree. A preliminary or temporary preliminary decree is issued for the other basins with the planning area (MDNRC 2010b). The Tongue River, Little Bighorn River, Rosebud Creek (78 percent examined), and lower Yellowstone River (90 percent examined) are not yet fully adjudicated (MDNRC 2010d).
In 1967, pursuant to section 89-2914 R.C.M. (Revised Code of Montana), 1947, a petition was granted to create

the Short Pine Controlled Groundwater Area in portions of Fallon, Prairie, and Wibaux counties (Map 21). In this area, no new appropriations of groundwater may be made except by permit request (regardless of size), no presently inactive well may be used except with the approval of MDNRC, and no presently active well may increase its flow rate except with the approval of MDNRC. This controlled groundwater area was created to protect the interests of local groundwater users in response to increased groundwater withdrawals by the Shell Oil Company.

In 1999, the MDNRC established the Powder River Basin Controlled Groundwater Area in anticipation of the withdrawal of groundwater associated with coal bed natural gas (CBNG) development (this applies to CBNG wells completed above the Lebo member of the Fort Union formation). In this area, CBNG development must follow the standards for drilling, completing, testing, and production of CBNG wells as adopted by the Montana Board of Oil and Gas Conservation (MBOGC), and the MDNRC has the authority to designate a Technical Advisory Committee to oversee groundwater characteristics and monitoring and reporting requirements. Within the area, CBNG operators must offer water mitigation agreements to owners of water wells and natural springs located within 0.5 miles of a CBNG field or within the area that the operator reasonably believes may be affected by a CBNG production operation, whichever is greater, and automatically extends 0.5 miles beyond any well adversely affected. Any beneficial use of CBNG-produced water requires water rights issued by the MDNRC, as established by law.

Within the planning area, two basins were closed to protect Tribal Water Rights under the Northern Cheyenne (MCA 85-20-301) and Fort Belknap Compact (MCA 85-20-100) closures in 1991 and 2001, respectively. In these areas, an approved Application for Beneficial Water Use Permit is required and the applicant is subject to the requirements of 85-2-360, 85-2-361, and 85-2-362 MCA for any water appropriation. The Northern Cheyenne-Montana Compact includes all of Rosebud Creek basin from its headwaters to its confluence with the Yellowstone River, in Big Horn and Rosebud counties. Fort Belknap-Montana Compact closure includes the Beaver Creek, Milk River, Missouri River, and Peoples Creek basins.

COAL BED NATURAL GAS

The potential effects on groundwater and surface water quantity and quality are caused by groundwater abstraction and drawdown concurrent with CBNG production and CBNG-produced water management and storage (NAS 2010). In January 2003, the BLM and State of Montana, anticipating an increase in CBNG development, published the *Final Statewide Oil and Gas Environmental Impact Statement and Proposed Amendment for the Powder River and Billings Resource Management Plans* (BLM, MBOGC, and MDEQ 2003). This environmental impact statement (EIS) analyzed various approaches for managing oil and gas resources statewide, with an emphasis on the Billings and Powder River RMP areas. This Final EIS and the BLM's 2008 *Record of Decision for the Final Supplement to the Montana Statewide Oil and Gas Environmental Impact Statement and Proposed Amendment of the Powder River and Billings Resource Management Plans* set management goals, addressed resource issues and concerns, established monitoring plans, and provided detailed reports on groundwater and surface water issues related to CBNG development. Refer to this document for a detailed analysis of CBNG development in the Powder River RMP area. Comparison of specific conductance versus flow, SAR versus flow, and SAR versus specific conductance do not indicate a definitive difference between pre- and post-CBNG data for the Tongue River (Bobst 2008). Most monitoring data using SAR and TDS of the Powder and Tongue rivers show no change in surface water quality resulting from CBNG-produced water discharge. There is not enough data, (e.g., background streamflow, climatic conditions) to determine the effects of CBNG-produced water discharge on flows in streams and rivers in the Powder River Basin. "Other physical effects to ephemeral or perennial streams and rivers, such as bank scouring, increased bottom sedimentation, or channel erosion due to regulated, controlled, and managed, or unregulated and/or unmanaged CBM [coal bed methane or CBNG] produced water discharges have been registered on private lands in the Powder River and Raton basins" (NAS 2010, p. 185).

HISTORIC AND FUTURE TRENDS IN CLIMATE AND HYDROLOGY

Climate change will continue to alter the water cycle through changes in precipitation timing, type, amount, and distribution; changes in drought; increases in evaporation rates and atmospheric water vapor; melting snow and

ice; increases in water temperature; and changes in soil moisture and overland flow. Atmospheric water vapor is an important and abundant GHG (Karl et al. 2009). Although anthropogenic sources of water vapor (including irrigation, impoundments, combustion) provide a small increase in atmospheric water, climate warming increases the amount of water vapor in the atmosphere through warmer temperatures that increase relative humidity and evaporation rates (Karl et al. 2009). Increased atmospheric water further increases surface temperatures and can contribute to changes in seasonal precipitation (Karl et al. 2009).

Over the past century, warmer spring temperatures have led to peak runoff dates 10 to 15 days earlier for the upper Yellowstone River at Corwin Springs, Montana (USGS 2012). Increasing standard deviations of mean annual streamflows over the 20th century show increasing interannual variability and therefore increasing frequency of extreme stream flows and flood events (Wagner 2003). There have been increasing trends (1958 to 2007) in end-of-summer drought as measured by the Palmer Drought Severity Index (Karl et al. 2009).

A change in seasonality of streamflow with increased winter flows, reduced magnitude and earlier spring peak flows, and reduced summer and fall flows are predicted. Additionally, with increases in annual precipitation, total annual flows could increase if higher temperatures do not negate this change through higher evapotranspiration rates (Wagner 2003).

Increases in air temperature will lead to increases in water temperature and changes in water quality. Dissolved oxygen levels will be reduced at higher water temperatures. Increased heavy precipitation events will lead to increased erosion and sedimentation (Karl et al. 2009). Climate change is projected to affect the capacity of surface water ecosystems to remove pollutants and improve water quality (USBOR 2011). The USEPA predicts that the number of waterbodies listed as impaired will increase (Karl et al. 2009). It is likely that a warmer climate (and changes in precipitation seasonality to a lesser degree) will lead to fewer, shorter duration wetlands in the Missouri River basin (USBOR 2011).

Groundwater resources may be impacted by reduced snowpack, earlier snowmelt, and reduced spring and summer flows through reduced recharge; however, warmer, wetter winters may increase recharge rates for this season (Wagner 2003) as well as increased flooding events. Changes in vegetation and soils would alter evaporation, erosion, and infiltration rates (Karl et al. 2009). Beneficial use demands (including agriculture) on water resources may change as a result of changing hydrology, temperatures, atmospheric CO_2 levels, O_3 levels, and increased evaporative losses (Wagner 2003).

VEGETATION

The vegetation classification descriptions within this section are from the National Vegetation Classification System. Based on this classification methodology, the planning area includes five general land groups: Northern Great Plains Mixedgrass Mesic Prairie group, Northern Great Plains Mixedgrass Dry Prairie group, Northwestern Great Plains-Black Hills Ponderosa Pine Forest and Woodland Group, Northern Rocky Mountain Ponderosa Pine Woodland and Savanna, and Great Plains Badlands Vegetation Group.

Outside of areas dedicated to another use (e.g. oil and gas pad locations, state highways, etc.), the condition or vigor of the vegetative communities on remaining BLM administered lands can be inferred through the interpretation of data from the Standards for Rangeland Health Assessment process (see *Livestock Grazing Section* for more information). This data illustrates that 95% of the BLM administered lands within grazing allotments are exhibiting healthy and diverse plant communities. Of the remaining 5% of the plant communities not achieving this benchmark, there is less than 0.01% that are not progressing towards a healthy functional plant community due to the area being allocated to recreational uses or repeatedly flooded and reinfested with invasive species.

PLANT COMMUNITIES

Northern Great Plains Mixedgrass Mesic Prairie Group

This mixedgrass group extends from northern Nebraska into southern Canada and westward through the Dakotas to the Rocky Mountain Front Range in Montana and Wyoming, on both glaciated and non-glaciated substrates. This group occurs on a wide variety of landforms (e.g., mesatops, stream terraces) and in proximity to a diversity of other groups. It includes mesic mixedgrass to tallgrass prairie on mostly moderate to gentle slopes, usually at the base of foothill slopes, e.g., the hogbacks of the Rocky Mountain Front Range where it typically occurs as a relatively narrow elevational band between montane woodlands and shrublands and the shortgrass steppe and mixedgrass prairie, but extends east on the Front Range piedmont alongside the Chalk Bluffs near the Colorado-Wyoming border, out into the Great Plains on the Palmer Divide, and on piedmont slopes below mesas and foothills in northeastern New Mexico. Soil texture is the defining environmental descriptor; soils are primarily mesic, fine- and medium-textured and do not include sands, sandy soils, or sandy loams. The growing season and rainfall are intermediate to drier units to the southwest and mesic tallgrass regions to the east. Graminoids typically comprising the greatest canopy cover include *western wheatgrass, green needlegrass,* and *big bluestem*. In Montana, this includes *idaho fescue*. Sites with a strong component of *green needlegrass* indicate a more favorable moisture balance and perhaps a favorable grazing regime as well because this is one of the most palatable of the mid grasses. Other species include *little bluestem, mountain muhly, sand dropseed, indiangrass, bluebunch wheatgrass, blue grama*, and *sideoats grama*. Shrub species such as *snowberry, fringed sagewort, and silver sagebrush* also can occur. Fire and grazing constitute the primary dynamics affecting this group. Drought can also impact it, in general favoring the shortgrass component at the expense of the mid grasses or shifting this to the Northern Great Plains Mixedgrass Dry Prairie Group (G331). With intensive grazing, cool-season exotics such as *Kentucky bluegrass, smooth brome*, and *Japanese brome* can increase in dominance. Shrub species such as *eastern redcedar* can also increase in dominance with fire suppression. Conversion to agriculture likewise has decreased the range of this group.

Northern Great Plains Mixedgrass Dry Prairie Group

This group is common in the northern and central Great Plains of the United States. Stands occur on flat to rolling topography with deep, sandy loam to loam, coarser-textured soils. This group occurs on a wide variety of landforms (e.g., mesatops, stream terraces) and in proximity to a diversity of other groups. The vegetation is dominated by moderate to moderately dense medium-tall grasses and scattered shrubs. Dominant species include *needle and thread, sun sedge, and threadleaf sedge. prairie sandreed* is often found with high cover values on sandier soils, and *prairie junegrass* cover increases on degraded sites. Other common species include *shortbristle needle and thread,* and *little bluestem*. Common woody species *include shrubby cincuefoil, horizontal juniper,and skunkbrush sumac.* Some examples may range into more of a shrub-steppe. Fire, drought, and grazing constitute the primary dynamics affecting this group.

Northwestern GreatPlains-Black Hills Ponderosa Pine Forest and Woodland Group

This group occurs throughout the Great Plains Division along areas that border the Rocky Mountain Division and into the central Great Plains. These are physiognomically variable woodlands, ranging from very sparse patches of trees on drier sites, to nearly closed-canopy forest stands on north slopes or in draws where available soil moisture is higher. This group occurs primarily on gentle to steep slopes along escarpments, buttes, canyons, rock outcrops or ravines and can grade into one of the Great Plains canyon groups or the surrounding mixedgrass prairie group. Soils typically range from well-drained loamy sands to sandy loams formed in colluvium, weathered sandstone, limestone, scoria or eolian sand. This group is primarily dominated by *ponderosa pine* but may include a sparse to relatively dense understory of *rocky mountain juniper.* Deciduous trees are an important component in some areas (western Dakotas, Black Hills) and are sometimes codominant with the pines, including *green ash, paper birch, bur oak, american elm, boxelder, and quaking aspen.* Important or common shrub species with ponderosa pine can include *kinnikinnick, creeping barberry, soapweed, snowberry, chokecherry, common juniper, horizontal juniper, serviceberry, andskunkbrush sumac*. The herbaceous understory can range from sparse to a dense layer with species typifying the surrounding prairie group, with mixedgrass species common, such as *Big bluestem, sideoats grama, sunsedge, threadleaf sedge,*

timber oatgrass, prairie junegrass, Green needlegrass, roughleaf ricegrass, western wheatgrass, littleseed ricegrass, and little bluestem.

Northern Rocky Mountain Ponderosa Pine Woodland and Savanna

This inland Pacific Northwest group occurs in the foothills of the Northern Rocky Mountains in the Columbia Plateau region and west along the foothills of the Modoc Plateau and Eastern Cascades into southern interior British Columbia. It also occurs east across Idaho into the eastern foothills of the Montana Rockies. These woodlands and savannas occur at the lower treeline/ecotone between grasslands or shrublands and more mesic coniferous forests, typically on warm, dry, exposed sites. These interior Pacific Northwest woodlands receive winter and spring rains, and thus have a greater spring "green-up" than the drier woodlands in the Central Rockies. However, sites are often too droughty to support a closed tree canopy. Elevations range from less than 500 m in British Columbia to 1600 m in the central Idaho mountains. Occurrences are found on all slopes and aspects; however, moderately steep to very steep slopes or ridgetops and plateaus are most common. This group generally occurs on most geological substrates from weathered rock to glacial deposits to eolian deposits. Characteristic soil features include good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, and periods of drought during the growing season. Some occurrences may occur as edaphic climax communities on very skeletal, infertile and/or excessively drained soils, such as pumice, cinder or lava fields, and scree slopes. Surface textures are highly variable in this group ranging from sand to loam and silt loam. Exposed rock and bare soil consistently occur to some degree in all the associations.

This group includes two physiognomic phases: true woodlands of *ponderosa pine* with shrubby or grassy understories, and "wooded steppes" with widely spaced, scattered *ponderosa pine* trees over generally shrubby but sparse understories. The former are generally fire-maintained, while the later are often too dry and with widely spaced vegetation to carry fire. *Ponderosa pine* is the predominant conifer; *Pinus flexilis* may be present in the tree canopy but are usually absent. The understory can be shrubby, with *big sagebrush, kinnikinnick, Symphoricarpos albus, Saskatoonberry, and common rose species* Deciduous shrubs, such as *snowberr, or white spirea*, can be abundant in more northerly sites or more moist climates. Herbaceous vegetation in the true savanna occurrences is predominantly fire-resistant grasses and forbs that resprout following surface fires; shrubs, understory trees and downed logs are uncommon. These more open stands support grasses such as *bluebunch wheatgrass, needlegrass speceis, , dry sedge species, squirreltail, Idaho fescue, or rough fescue*. The more mesic portions of this group may include *pinegrass or geyers sedge*, species more typical of Northern Rocky Mountain Douglas-fir - Pine Forest Group (G210). Mixed fire regimes and ground fires of variable return intervals maintain these woodlands typically with a shrub-dominated or patchy shrub layer, depending on climate, degree of soil development, and understory density. Historically, many of these woodlands and savannas lacked the shrub component as a result of 3- to 7-year fire-return intervals.

Great Plains Badlands Vegetation Group

This macrogroup description is based on member group characteristics G566. This group includes badlands vegetation in the Northern Great Plains of the United States and Canada. Examples are found on slopes of easily erodible clay and poorly consolidated shale interspersed with sandstone, lignite lenses, and occasional scoria outcrops. Vegetation cover is typically sparse but can be moderate in small areas with shallower slopes. The dominant vegetation is a mix of shrubs, forbs and grasses with each dominating some areas. There is typically zonation of vegetation from the top of a slope to the bottom with different groups of species most common in certain zones. Typical species found in Great Plains badlands are *greasewood, saltbush, longleaf wormwood, big sagebrush, broom snakeweed, buckwheat, and bluebunch wheatgrass.*

PLANT SPECIES OF CONCERN

There are no known threatened or endangered plant species on public lands within the planning area. There are occurrences of BLM sensitive species, which are managed in cooperation with state and federal agencies. Sensitive species are those species documented on BLM-administered land and determined, through review with the BLM and the Montana Natural Heritage Program (MNHP), to be rare or imperiled.

The BLM Sensitive Plant Species

BLM's 6840 Manual, *Special Status Species Management*, gives the BLM State Director the responsibility of designating BLM Sensitive Species and periodically updating the list in cooperation with state government and natural heritage programs. The sensitive species classification recognizes that conservation actions are needed to preclude the species from listing and improve the status of species so special status recognition is no longer warranted. The sensitive species within table 3-13 are those species known to occur on BLM-administered lands or lands affected by BLM-authorized actions.

As referenced in the BLM Manual 6840, conservation of special status species means the use of all methods and procedures necessary to improve the condition of special status species and their habitats to a point where special status recognition, is no longer warranted.

Federally listed species may have habitat considered crucial to species viability. For those listed species without critical habitat designation, the BLM cooperates with the USFWS to determine and manage important habitats.

State Species of Concern

In addition to species that are federally protected under the Endangered Species Act (ESA), the State of Montana has designated additional species of concern within its jurisdictional boundaries (Table 3-13). There are five rankings for State Species of Special Concern but this document focuses only on the highest ranking (S1). This ranking is defined as critically imperiled due to extreme rarity (five or fewer occurrences or very few remaining individuals) or because some factor of its biology make it especially vulnerable to extinction.

Climate change may also pose challenges for many resource uses on BLM-administered land. Drought and evaporation may reduce seasonal water supplies, which in turn reduces the growth and vigor of special status plants and species of concern. However, in non-drought years, longer growing seasons resulting from thermal increases may increase vegetative growth and vigor throughout the year for special status plants and species of concern.

The BLM considers potential adverse effects and recommend mitigation measures for affected special status plant species in site-specific, project-level planning documents. When potential special status plant species might be affected, the BLM adjusts management actions to protect or enhance the species occurrences. The BLM cooperates and collaborates with federal, tribal, and state agencies and private landowners to actively conserve and improve special status plant species habitats and populations.

HARDWOOD DRAWS

Native hardwood draw habitats occur as isolated islands, pockets or stringers throughout the Great Plains. These habitats compose about 1% of the vegetation of the Northern High Plains (Bjugstad 1977). Upland hardwoods alone occupy less area (Girard et. al 1985). While the distribution of these woodlands is extremely limited, their value both economically and ecologically is quite great. They provide critical habitat for a number of wildlife species, shade and shelter for livestock, stabilization of the soil and a source of firewood (Girard et. al 1985).

Hardwood draw habitats typically include green ash, boxelder, plains cottonwood, Rocky Mountain juniper, Russian olive, common chokecherry, silver buffaloberry, golden current, gooseberry, snowberry and silver sagebrush. A shrubby border characterizes the woodland/grassland interface at most sites, which forms a stairstep pattern from the shorter species of the grassland, to shrubby species of snowberry, Wood's rose, skunkbrush sumac and silver buffaloberry, then sapling species of chokecherry and serviceberry, and ending with taller tree overstory species containing green ash, boxelder, plains cottonwood, rocky mountain juniper, and Russian olive (Girard et. al. 1985).

Upland hardwood habitats are often located in draws as isolated pockets and stringers, on north-**facing slopes** and following intermittent streams and drainageways. Establishment and survival of upland hardwood draws is apparently closely linked to areas of increased moisture (Girard et. al. 1985). The majority of these woodlands

TABLE 3-13.
PLANT SPECIES OF CONCERN IN THE PLANNING AREA

Common Name	Scientific Name	Counties of Known Occurrence	Classification	
			MT	BLM[1]
Lead plant	*Amorpha canescens*	Carter and Rosebud	SH	S
Ovalleaf milkweed	*Asclepias ovalifolia*	Carter	S1	
Narrowleaf milkweed	*Asclepias stenophylla*	Carter and Rosebud	S1	S
Barr's milkvetch	*Astragulus barrii*	Big Horn, Carter, Powder River, and Rosebud	S2S3	S
Geyer's milkvetch	*Astragulus geyeri*	Garfield	S2	S
Raceme milkvetch	*Astragalus racemosus*	Carter and Fallon	S2S3	
Roundleaf water-hyssop	*Bacopa rotundifolia*	Garfield	S1S3	
Crawe's Sedge	*Carex crawei*	Prairie	S2	S
Pregnant sedge	*Carex gravida var. gravida*	Big Horn, Powder River, and Rosebud	S1	
New Jersey tea	*Ceanothus herbaceous*	Powder River	SH	
Alderleaf mountain-mahogany	*Cercocarpus montanus var. glaber*	Treasure	S1S2	
Smooth goosefoot	*Chenopodium subglabrum*	Carter, Custer, and Powder River	S1	
Wyoming thistle	*Cirsium pulcherrimum*	Powder River	S1	
Schweinitz' flatsedge	*Cyperus schweinitzii*	Prairie and Carter	S2	S
Nine-anther prairie clover	*Dalea enneandra*	Custer	S1	
Silky prairie clover	*Dalea villosa var. villosa*	Carter	S1	
Scribner's panic grass	*Dichanthelium oligosanthes var.*	Powder River	S1	
Visher's buckwheat	*Eriogonum visheri*	Carter	S1	S
Spotted joepye-weed	*Eupatorium maculatum*	Big Horn	S1S2	
Bush morning-glory	*Ipomoea leptophylla*	Big Horn, Rosebud, and Treasure	S1S2	
Pale-spiked lobelia	*Lobelia spicata*	Dawson and Richland	S2	S
Nuttall's desert parsley	*Lomatium nuttallii*	Big Horn and Rosebud	S1	S
Bractless blazingstar	*Mentzelia nuda*	Custer, Powder River, Roosevelt, and Rosebud	S1S2	S
Blue toadflax	*Nuttallanthus texanus*	Carter, Dawson	S1	S
Little indian breadroot	*Pediomelum hypogaeum*	Carter, Powder River, and Rosebud	S2S3	S
Narrowleaf penstemon	*Penstemon angustifolius*	Carter	S2	S
Large flowered beardtongue	*Penstemon grandiflorus*	Custer	S1	
Hot spring phacelia	*Phacelia thermalis*	Garfield	S1	S
Plains phlox	*Phlox andicola*	Carter, Powder River, and Rosebud	S2	S
Double bladderpod	*Physaria brassicoides*	Carter, Custer and Powder River	S2	S
Woolly twinpod	*Physaria didymocarpa var. lanata*	Big Horn and Rosebud	S1	S
Silver bladderpod	*Physaria ludoviciana*	Carter and Fallon	S2S3	
Slender-branched popcorn-flower	*Plagiobothrys leptocladus*	Custer	S1	
Sand cherry	*Prunus pumila*	Fallon	S1	S
Dwarf woolly-heads	*Psilocarphus brevissimus*	Rosebud	S2	S
Bur oak	*Quercus macrocarpa*	Carter	S1	S
Persistent-sepal yellow-cress	*Rorippa calycina*	Big Horn, Custer, Rosebud, and Treasure	S1	S
Desert groundsel	*Senecio gremophilus*	Big Horn	S1S2	
Prairie aster	*Solidago ptarmicoides*	Carter	S1	
Rock-tansy	*Sphaeromeria capitata*	Big Horn	S3	
Slender wedgegrass	*Sphenopholis intermedia*	Big Horn	S1	
Letterman's needlegrass	*Stipa lettermanii*	Big Horn	S1	
Poison suckleya	*Suckleya suckleyana*	Dawson and Roosevelt	S1	S
Soft aster	*Symphyotrichum molle*	Big Horn	S1S3	
Nannyberry	*Viburnum lentago*	Big Horn, Richland	S1	S

Source: BLM 2008g. [1]If blank, then it does not occur on BLM-administered lands. S: sensitive. S1: At risk because of extremely limited or rapidly declining numbers, range and or habitat, making it highly vulnerable to extirpation in the state. S2: At risk because of very limited or declining numbers, range or habitat, making it vulnerable to extirpation in the state. S3: At risk because of very limited or declining numbers, range or habitat, making it vulnerable to extirpation in the state. SH: Possibly extinct-species known from only historical occurrences, but may nevertheless still be extant, further searching is needed.

occur on convergent landforms (Richardson 1979) which are more mesic due to one or a combination of the following factors: run-in from adjacent uplands, springs or seeps resulting from through-flow from upper topo-positions, interception of the water table, and/or increased snow catch.

These hardwood draw habitats contribute to the species richness of the flora and fauna of the grasslands, form critical habitat for a number of wildlife species, and constitute a potential source of income. Many of these woodlands in the Northern Great Plains are in a state of decline or decay due to a number of factors (Girard et. al. 1985). Lesica et al. (2003 and 2009) indicate that competition from herbaceous plant species, mainly non-native smooth brome grass, is the limiting factor in allowing green ash regeneration. While Keigley et.al (2009) suggest that once regeneration does occur for chokecherry, browsing of young plants by livestock and wildlife can be an important adverse influence in maintaining the regeneration.

SEED COLLECTION AND HAYING

The scattered land ownership pattern has led to requests for haying of vegetative material. These requests have been approved on a case by case basis. Forage (Animal Unit Months [AUMs]) available for grazing have been reduced in the year the hay has been harvested proportional to the amount of vegetation hayed.

BLM will follow current guidance and policy concerning seed collection including IM WO-2013-176.

RIPARIAN AND WETLAND AREAS

Riparian and wetland areas combine water, increased vegetation, shade, and a favorable microclimate to create the most biologically diverse habitat found on BLM-administered lands. Riparian and wetland areas contribute to recreational values, fish and wildlife, water supply, and cultural and historic values as well as economic values related to livestock production, timber harvest, and mineral extraction.

Literature defines riparian and wetland areas as those saturated or inundated at a frequency and duration sufficient to produce vegetation typically adapted for life in saturated soil conditions. These areas are also transitional areas between permanently saturated wetlands and upland areas often referred to as riparian areas; these transition areas have vegetation or physical characteristics reflective of permanent surface or subsurface water influence (Prichard et al. 1999).

Riparian and wetland areas may be associated with lakes, reservoirs, estuaries, potholes, springs, bogs, and wet meadows as well as ephemeral, intermittent, or perennial streams. Within wetlands, riparian areas are those areas geographically delineated by distinctive resource values and characteristics composing aquatic and riparian ecosystems. Intermittent and ephemeral streams are not classified separately for riparian areas until assessments have been conducted for each stream reach.

Riparian and wetland areas are assessed based on their potential and capability. The potential of a riparian or wetland area is defined as the highest ecological status a riparian or wetland area can attain given no political, social, or economic constraints. This is often referred to as the potential natural community (Prichard et al. 1999). Capability is defined as the highest ecological status an area can attain given political, social, or economic constraints (often referred to as limiting factors) (Prichard et al. 1999).
BLM conducts Propper Functioning Condition (PFC) assessments as a qualitative method for assessing the conditions of riparian and wetland areas. It involves a consistent approach for assessing hydrology, riparian vegetation, soils, physical state, and processes to determine the overall condition or health of riparian and wetland areas. Changes are necessary to allow recovery in areas that do not meet PFC. Based on a tiered classification system, individual sites are assessed and placed into categorized functional ratings.

Within the planning area, 682 miles (Table 3-14) of riparian stream areas are assessed for condition and there is are 13,670 miles of stream channels and drainages that may contain riparian and wetland areas that are not currently assessed for functioning condition and functional rating.

TABLE 3-14.
RIPARIAN STREAM FUNCTIONAL
RATING FOR THE PLANNING AREA

Functioning Rating	Miles	Percentage of Total (%)
PFC	411	61
Functional-at risk	239	35
Functional-at risk with downward trend	42	6
Functional-at risk with upward trend	76	11
Functional-at risk with static trend	62	9
Functional-at risk, not apparent	59	9
Nonfunctional	27	4

PROPOSED CARTER MASTER LEASING PLAN AREA

An area in Carter County has been identified for an oil and gas MLP (see *Oil and Gas* for more information on MLPs). The Carter MLP area contains riparian areas overlying areas with oil and gas development potential (Table 3-15).

TABLE 3-15.
BLM-ADMINISTERED RIPARIAN ACRES
WITH OIL AND GAS DEVELOPMENT POTENTIAL
IN THE PROPOSED CARTER MASTER LEASING PLAN AREA

Type of Acres	Acres of Riparian Areas
High Oil and Gas Development Potential Surface Acres	200
High Oil and Gas Development Potential Mineral Acres	1,800
Medium Oil and Gas Development Potential Surface Acres	2,800
Medium Oil and Gas Development Potential Mineral Acres	7,300
Low Oil and Gas Development Potential Surface Acres	2,900
Low Oil and Gas Development Potential Mineral Acres	7,300

INVASIVE SPECIES

BLM utilizes an Integrated Invasive Species/Pest Management approach (using, but not limited, to manual, mechanical, prescribed fire, chemical, biological, cultural, and educational methods) and works within federal guidelines, laws, statutes, plans, and regulations to manage infestations of invasive species on the BLM-administered lands. For discussion, the different classifications of invasive species includes invasive non-native species (e.g. crested wheatgrass or smooth brome), invasive native species (e.g. red three-awn) and noxious weeds (e.g. leafy spurge).

INVASIVE NATIVE OR NON-NATIVE GRASS SPECIES

Invasive nonnative or native plant species are not indigenous to the planning area and spread readily into healthy native plant communities. These species are typically detrimental to native ecosystems and included crested wheatgrass, red three awn, and smooth brome. It is estimated 70,000 acres of BLM administered lands were intentionally seeded to non-native crested wheatgrass during the dust bowl in the 1930s to the 1940s for soil stabilization. In addition, red-threeawn, a native plant species to the southwest United States, appears to have been introduced within the crested wheatgrass seed. Smooth brome, introduced as a suitable species for agricultural hay production, has invaded riparian areas and hardwood draws. These species has since spread to adjoining native plant communities and contributed to economic losses, reduced rangeland productivity, reduced structural and species diversity, and degraded and fragmented wildlife habitat.

Invasion of cheatgrass and subsequent effects to wildfire frequency and severity and related sagebrush habitats *is not* an issue within planning area. Although cheatgrass does occurs, past fire history and research has repeatedly demonstrated a healthy northern mixed-grass prairie plant community is resilient to cheatgrass expansion. Haferkamp studying annual bromes including cheatgrass in eastern Montana, concluded there would be no ecological shift of northern mixed-grass prairies toward annual grass dominance. Instead he provide the amount and abundance of annual bromes occurring on Northern Great Plains rangeland is cyclic, depending on seedbank, temperature, amount and distribution of precipitation, (Haferkamp, 2001). He goes on to say expansion of annual bromes in mixed –grass prairie communities is buffered by two long-lived perennial grasses (western wheatgrass and blue grama), especially where grazing management maintains healthy native mixed-grass prairie vegetation. Vermiere et al. (2011) studied effects of fire on perennial and annual grasses (including cheatgrass) and found increased production of western wheatgrass and decreased annual grass production following summer fire in the northern mixed-grass prairie.

Climate Change research also suggests there would not be a cheatgrass invasion into the Northern Great Plains. In particular, climate change modeling (Bradley 2009) illustrates the median precipitation change scenario (used to identify the most likely future climate change) depicts no increase in cheatgrass climatic habitat within the planning area.

Noxious Weeds

Noxious weeds are undesirable native or nonnative plants that been designated by the State of Montana or declared as such by the county weed control districts. There are 32 designated noxious weeds on the Montana Noxious Weed List. Based on observations and reports by the county weed control districts, invasive plant species control measures are limiting population sizes in some cases. Inventory and monitoring for invasive plant species is ongoing, but currently the data are insufficient to project the rate or spread of invasive plant species in the planning area.

Historical invasive plant species infestations in the planning area likely began as small patches in disturbed areas because of development, fire, roadway and utility corridors, livestock concentration areas, recreation, or OHV trails. Intense fire or improper grazing are disturbance factors that promote invasive plant species invasions. Although data are not available, the spread of initial infestations in the planning area are thought to have occurred through seed or other propagate transport to disturbed areas by wildlife, livestock, vehicles, people, water, or wind.

Changes in vegetative frequency; construction of roads, utility corridors, and well pads; and the concentration of livestock and wildlife in some areas have exposed bare soil and provided a seedbed for the establishment of invasive plant species in the planning area. These, as well as other historical vegetative disturbances and activities (e.g. recreation, and OHV use), have encouraged the spread of invasive species in the planning area. Climate change is likely combining with other human-induced stress to further increase the vulnerability of ecosystems to other pests, invasive species, and loss of native species.

COOPERATIVE MANAGEMENT IN INVASIVE PLANT SPECIES AND PEST CONTROL

The BLM controls invasive plant species and pests (e.g. grasshoppers) on public lands through cooperative agreements with various federal agencies and county weed control districts. The BLM also implements contracts for specific areas to control invasive plant species and employs a seasonal weed crew to treat smaller infestations. The primary invasive species targeted for control in the planning area include Russian knapweed, spotted knapweed, diffuse knapweed, leafy spurge, Canada thistle, common hound's-tongue, field bindweed, and salt-cedar. These species are typically found in sagebrush and grassland, desert shrub, and riparian and wetland communities.

Methods used to reduce invasive plant species density and control population size across the planning area include chemical, mechanical, biological, or a combination of these treatments. Approximately 1,050 acres of invasive plant species are chemically treated annually within the planning area. The BLM also addresses weed control relating to lands and realty, wildlife, range, recreation, oil and gas, and other mineral-related actions.

Management challenges for invasive plant species include, managing BLM-authorized activities in the planning area that disturb the soil or otherwise create an opportunity for the establishment of invasive plant species; educating resource users regarding the spread, early detection, and control of invasive plant species; and determining effectiveness of invasive plant species control without a completed invasive plant species inventory and a comprehensive invasive plant species management program. These challenges require coordination across all of the BLM's resource programs to develop, integrate, and implement aggressive management techniques and strategies for controlling the impacts and spread of invasive plant species in the planning area.

FISH, AQUATIC AND WILDLIFE HABITAT, INCLUDING SPECIAL STATUS SPECIES

MANAGEMENT RESPONSIBILITIES

The BLM is responsible for the wildlife habitat management on BLM-administered lands. The management of wildlife populations is the responsibility of state and/or federal wildlife management agencies. For example, Montana Fish, Wildlife and Parks (MFWP) manages resident wildlife populations in two regions (MFWP Region 7 and portions of Region 6) within the planning area. The USFWS, provides regulatory oversight for all listed species and proposed for listing under the ESA. The USFWS administers the Migratory Bird Treaty Act (16 United States Code [U.S.C.] 703 et seq.) which protects migratory bird species. They also administer the Bald and Golden Eagle Protection Act, which prohibits anyone from taking bald and golden eagles, their eggs, parts, or nests without a permit issued by the USFWS, and protects eagles from impacts of human-initiated activities primarily around active, alternate, and historical nest sites.

HABITAT CONDITIONS AND PRIORITY HABITATS FOR MANAGEMENT

Habitat Conditions

Historic impacts to wildlife habitat have occurred in varying degrees. Consequently, some areas contain well-functioning habitats while others contain habitats at a lesser level of functionality; some areas contain large, contiguous blocks of native habitat while other areas contain small, fragmented patches of native habitats. One method to measure the condition of the wildlife habitat on BLM administered lands is through the application for the Standards for Rangeland Health Standard 5 - Habitats are provided for healthy, productive, and diverse native plant and animal populations and communities. Standards for Rangeland Health Standard 5, has been assessed on all the grazing allotments in the planning area. Finding from these assessments indicate that 98% of the BLM administered land allocated to grazing use is fully meeting Standard 5; while 2% of the BLM administered land has had management actions taken and is progressing towards meeting Standard 5.

Priority Habitats for Management

BLM planning guidance provides direction for the designation of priority species and priority habitat for management. In addition, to BLM Special Status Species, this would also include those habitats occupied by a species recognized as significant for one factor such as density, age, diversity, public interest, or remnant character. Priority habitats for management include those habitats containing:

- BLM Special Status Species
- Migratory birds
- Bighorn sheep
- Pronghorn antelope
- Mule deer
- White-tailed deer
- Rocky Mountain elk
- Sharp-tailed grouse
- Greater sage-grouse

AQUATICS

The aquatic resources include aquatic wildlife and habitat for fish, aquatic arthropods (insects and crustaceans), amphibians, reptiles, and bivalves. The habitat consists of rivers, streams, lakes, reservoirs, springs and seeps that provide habitat for a variety of aquatic wildlife and riparian communities. Nomenclature for the aquatics sections is from the MNHP Montana Field Guide (MFWP and MNHP 2012).

Based on known fish presence (MFWP 2010b; Ostovar 2007), there are approximately 293 miles of fish-bearing streams on BLM-administered lands. Discovery of additional prairie streams that support native fish and other aquatic wildlife continues as state and federal agencies progress on stream survey efforts. The survey data illustrates prairie fish move through a landscape that balances, at the local and landscape scale, drying and flooding stages. In the Northern Great Plains, this landscape balance is illustrated through native aquatic wildlife being adapted to warm, turbid conditions of prairie streams and rivers.

At the landscape scale, aquatic wildlife habitat is inherently, connected directly or indirectly, with climate driven changes, to other resources (e.g. soil, water and riparian resources). There is evidence that recent climate change (e.g. global warming) is affecting aquatic biological systems at the global scale (IPCC 2007). At this time, there is less conclusive evidence for how warming would affect aquatic wildlife in this region. The increased temperature would raise water temperatures in lakes, reservoirs, rivers, and streams. Presumably, if water temperatures in the Northern Great Plains increased, changes in fish populations would occur.

Warming trends would also initiate drying events (Johnson et al. 2010) affecting aquatic wildlife habitat, which may be the greatest impact to prairie streams in this region, as prairie streams already balance between drying and flooding stages. In this region, intermittent streams are hotspots of biological diversity and drying events would have detrimental effects to this native biodiversity. Climate change is likely to combine with other human-induced stressors to increase the vulnerability of these ecosystems to pests, invasive species, and loss of native species.

In addition to climatic conditions, aquatic habitat conditions of streams are influenced by riparian vegetation, upland range conditions, land uses, and quality and quantity of in-stream water. Habitat conditions vary between and within water bodies. For example, the upper and middle reaches of smaller streams may be intermittent, while the lower reaches may receive perennial flows, resulting in different habitat conditions and different aquatic communities within the same stream. Prairie fisheries are adapted to these cycles of drying and flooding and can thrive in intermittent pools, provided land-use impacts are not severe (Bramblett, Johnson, Zale, and Heggem 2005).

Vegetation adjacent to aquatic habitats is a source of organic nutrients and food items for the prairie stream ecosystem provides in-stream habitat for fish and invertebrates, adds structure to the banks, and reduces erosion; when riparian vegetation senesces and falls into the stream, it adds cover, habitat complexity, and moderates water temperatures. If riparian habitats are degraded, the results include increases in erosion and sedimentation, changes in channel substrate, shallower and wider streams (which increases evaporation), increases in temperature fluctuations, and critically low oxygen content levels. These effects collectively alter, reduce or degrade aquatic wildlife habitat.

The linear characteristics of aquatic habitat coupled with the scattered distribution of BLM-administered lands results in difficulties describing specific habitat conditions relative to one owner. As a result, the current conditions of aquatic resources are presented in terms of overall habitat conditions, stream types, and fish species distribution and diversity.

Major Waterbodies

Primary reservoirs and lakes include Fort Peck, Tongue River, and Whitetail reservoirs and Medicine and Box Elder lakes. The largest lakes or reservoirs are Fort Peck Reservoir (249,349-acre surface area), Tongue River Reservoir (3,600 acres), and Medicine Lake (8,930 acres). Because they are larger in size and greater in depth, these waterbodies are able to provide habitat for a wide array of fishes with different niches; all three of these

water bodies are managed for a combination of cold- and warm-water fish species (MFWP 2010b). Most of the smaller reservoirs are habitat for warm-water species and some cold-water species such as rainbow trout (*Onchorhyncus mykiss*).

Of the large reservoirs, Fort Peck Lake contains the most diverse fish species (approximately 50 species). Sixteen species, including two species of salmon (Chinook and kokanee), have been introduced to develop sport-fishing opportunities, and the reservoir's walleye fishery has been of particular interest to resident and non-resident anglers. The Tongue River Reservoir has 19 species, and Medicine Lake contains three species of fishes.

Fish and Aquatic, Use and Relative Abundance

The planning area supports 63 species of fish, including 35 native and 28 nonnative species (Holton and Johnson 2003). Fish use varies considerably, with the greatest numbers of fish species found in the larger rivers and more downstream reaches of tributary streams and comparatively fewer species present in upstream tributary reaches.

The greatest fish diversity (46 species) occurs in the Missouri River, which is habitat for 33 native species (MFWP 2010b). Of the other large rivers, the Yellowstone River has 28 native species (40 total); the Tongue River, 25 (39 total); and the Musselshell River, 28 (38 total). The other major rivers and streams typically support 17 to 30 total species and 12 to 25 native species. The most abundant game fish species include channel catfish (*Ictalurus punctatus*), northern pike (*Esox lucius),* sauger (*Sander canadensis*), smallmouth bass (*Micropterus dolomieu*), and walleye (*Sander vitreus*) (MFWP 2010b). Less abundant game species include rainbow trout (*Oncorhynchus mykiss*), lake trout (*Salvelinus namaycush*), largemouth bass (*Micropterus salmoides*), shovelnose sturgeon (*Scaphirhynchus platorynchus*), yellow perch (*Perca flavescens*), paddlefish (*Polyodon spathula*), burbot (*Lota lota*), Chinook salmon (*Oncorhynchus tshawytscha*), kokanee salmon (*Oncorhynchus nerka*), cisco (*Coregonus artedi*), black crappie (*Pomoxis nigromaculatus*), and white crappie (*Pomoxis annularis*). Cold-water fisheries are maintained primarily through hatchery planting programs, primarily in the reservoirs, ponds, and lakes.

The most abundant non-game fish species include goldeye (*Hiodon alosoides*), common carp (*Cyprinus carpio*), sand shiner (*Notropis stramineus*), flathead chub (*Platygobio gracilis*), fathead minnow (*Pimephales promelas*), lake chub (*Couesius plumbeus*), creek chub (*Semotilus atromaculatus*), longnose dace (*Rhinichthys cataractae*), green sunfish (*Lepomis cyanellus*), and white sucker (*Catostomus commersoni*).

Numerous aquatic amphibians and reptiles within the planning area are dependent on prairie stream and river ecosystems (Werner, Maxell, Hendricks, and Flath 2004). In general, little is known about the ecology or habitat of many of these species; however, many of the species are associated with prairie streams for all or part of their life cycle. For example, woodhouse's toads (*Bufo woodhousii*) use larger rivers and reservoirs, particularly along the Yellowstone and Missouri rivers, for part of their lifecycle. Boreal chorus frogs (*Pseudacris maculata*) use shallow water areas for breeding and tadpole development, but then become primarily terrestrial.

Other amphibians and reptiles, that exhibit the same trend of relying on prairie streams for various parts of their lifecycle, includes Great Plains toads (*Bufo cognatus*), northern leopard frogs (*Rana pipiens*), plains spadefoot toads (*Spea bombifrons*), and the tiger salamander (*Ambystomia tigrinum*), spiny softshell turtles (*Apalone spinifera*), snapping turtles (*Chelydra serpentine*), painted turtles (*Chrysemys picta*), western hog-nosed snakes (*Heterdon nasicus*), milksnakes (*Lampropeltis triangulum*), plains gartersnakes (*Thamnophis radix*), common gartersnakes (*Thamnophis sirtalis*), terrestrial gartersnakes (*Thamnophis elegans*), eastern racers (*Coluber constrictor*) , and smooth greensnakes (*Opheodrys vernalis*).

Limiting Factors

Principle factors limiting or affecting aquatic resources within the planning area include the lack of a normative flow regime; loss or degradation of riparian habitat; habitat fragmentation; improper livestock grazing; improper oil, gas, and mining practices; and excess siltation due to the various land use activities. The large

number of ponds and reservoirs disrupt the landscape scale linear connections that drive stream ecosystem processes and lead to landscape-scale water evaporation (Vannote, Minshall, Cummins, Sedell, and Cushing 1980; Dodds et al. 2004).

In addition to habitat driven limiting factors, nonnative or introduced fish species, amphibians, and riparian vegetation can affect native species populations and distribution. Introduced fish species, particularly game fish, are ubiquitous. Impacts of introduced fishes on native fish communities include predation, introduction of diseases and parasites, competition for food and habitat, and hybridization. However, some nonnative species (e.g., walleye, smallmouth bass, and rainbow trout) are the foundation of popular fisheries that provide recreational and economic benefit. Additionally, introduced amphibians (e.g. American bullfrog (*Rana catesbeiana*)) and riparian vegetative species (e.g. salt-cedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*)) can out-compete native species that are key components of the physical and chemical habitat and those that provide food and substrate for aquatic wildlife.

Proposed Carter Master Leasing Plan Area

Within the MLP, the Little Missouri River, Boxelder Creek, and many smaller intermittent streams are fish-bearing streams. Previous discussion related to species presence and threats is applicable to the aquatic habitat within the Carter MLP.

TERRESTRIAL WILDLIFE HABITAT

Big Game (mule deer, white-tailed deer, pronghorns, Rocky Mountain elk, and bighorn sheep).

Mule deer (*Odocoileus hemionus*) are the most abundant big game species in the planning area and use the greatest diversity of habitats. Year-round mule deer distribution includes most BLM-administered lands. Little or no seasonal migration of mule deer occurs in southeastern Montana (BLM 1984). While mule deer use all habitat types, they generally prefer sagebrush, grassland, hardwood draws, badland breaks and conifer habitats. Broken terrain and browse availability within these habitats provides important cover or nutritional value to the species.
Mule deer populations have declined and rebounded at least twice since the late 1970s. The population peaked in the early 1980s and then declined for approximately 5 years as a result of drought, poor winter survival, and liberal harvests (BLM 1995). Recent MFWP survey data for mule deer indicated a decrease from the long-term (H. Burt, personal communication, February 4, 2011).

Although less abundant than mule deer, white-tailed deer (*Odocoileus virginianus*) are common in the planning area. White-tailed deer prefer riparian habitats and conifer areas, but they will also use a variety of other habitats. During the winter, white-tailed deer using forested areas prefer dense canopy, moist habitat types, uncut areas, and low snow depths. Suitable winter habitat is a key factor for white-tailed deer survival, and winter concentration areas occur almost exclusively in riparian and wetland habitats and dense pine (Youmans and Swenson 1982). Although white-tailed deer move on and off winter habitats, as dictated by seasonal habitat requirements, the animals do not migrate long distances.

Pronghorn antelope are the second most abundant big game species in the planning area. Although generally associated with grasslands and shrublands, they will also use agricultural fields. Approximately 2 million acres of pronghorn antelope habitat occurs on BLM-administered lands. Yearlong pronghorn habitat is always associated with grassland/shrublands and rarely includes significant amounts of conifers. Crucial pronghorn winter habitat is largely contained within areas identified as greater sage-grouse priority habitats and at a lower level within crucial mule deer winter range.

Rocky Mountain elk (*Cervus canadensis*) are associated with grasslands, shrublands, woodlands, and riparian and wetland areas. Crucial elk winter habitat has not been identified within the planning area. The species is common in the Missouri Breaks and scattered throughout the Custer National Forest including surrounding BLM-administered lands. Elk are expanding throughout the planning area and can now be found in areas of Custer and Prairie counties.

Bighorn sheep occur as a single herd and are located primarily in the Powder River Breaks area in Custer County (Map 22). Occasionally they are observed in the Pine Hills area. Approximately 68,500 of the occupied area occurs on BLM-administered lands. Bighorn sheep habitat includes badlands, breaks and rolling foothills with open to semi-open conditions (i.e., rocks, grasses, shrubs).

Although there is little or no seasonal migration for big game species within the planning area, there are winter habitats crucial for big game survival during periods of harsh winters. This crucial winter habitat (i.e. crucial winter range) is typically located on relatively large landscapes supporting a diversity of slopes, aspects, and topographic features. Crucial winter range is often part of year-round habitat and is typically dominated by important shrub species, such as rubber rabbitbrush, skunkbush sumac, and saltbush. Breaks, badlands, and brushy draws are examples of preferred winter range in open prairie country. Additional habitat types of importance as crucial mule deer winter range, also includes hardwood and pine forests. These habitat types provide escape and thermal cover, which are also important for maintenance and survival.

The importance of the crucial winter range to the survival of the big game species is illustrated by the percentage of the mule deer population occupying the area during harsh winters. MFWP observed that 73 percent of the mule deer seen in winter concentration areas in southeastern Montana were in rough topography, particularly in pine-dominated habitats (Youmans and Swenson 1982). While along the Powder and Little Missouri rivers, riparian habitat accounted for 94 percent of the wintering mule deer concentrations.

Game Birds (sharp-tailed grouse, wild turkeys, ring-neck pheasants, gray partridge, waterfowl)

Upland game birds include sharp-tailed grouse (*Tympanuchus phasianellus*), greater sage-grouse (*Centrocercus urophasianus*), wild turkey (*Meleagris gallopavo)*, ring-necked pheasant (*Phasianus colchicus)*, and gray partridge (*Perdix perdix).* The greater sage-grouse is considered a special status species and addressed further in *Special Status Species, Fish and Wildlife*. Sharp-tailed grouse is a BLM priority species for management because of public interest, the species is native to the planning area and the BLM manages a significant habitat. Wild turkeys, ring-neck pheasants, gray partridges, and waterfowl are not a BLM priority species for management and will not be discussed further due to the limited BLM administered managed habitat for the species or the species being non-native to the planning area.

Sharp-tailed grouse are widely dispersed through the planning area. Approximately 1,483 sharp-tailed grouse dancing grounds (lek) have been documented in the planning area, with approximately 200 of these leks occurring on BLM-administered lands. Identification of leks is ongoing and many additional leks are suspected to occur on public land throughout the planning area. The primary threats to sharp-tailed grouse populations include habitat loss and adverse weather.

Migratory Birds

A variety of migratory bird species, including numerous Special Status Species listed on Table 3-18, are found throughout the planning area. For the conservation of migratory birds, the BLM entered into an MOU with the USFWS in 2010. In addition to the MOU, Executive Order 13186, 66 Fed. Reg. 3853, (January 17, 2001), entitled "Responsibilities of Federal agencies to Protect Migratory Birds," directs agencies to take actions to further implement the migratory bird conventions, the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA) and other pertinent statutes. The combination of the executive order and the MOU provides the framework for BLM's habitat management for migratory birds.

As identified through the *Montana Partners in Flight Bird Conservation Plan* (2000), migratory birds of greatest conservation concern and BLM Sensitive Species in the planning area are the following: piping plover, mountain plover, interior least tern, burrowing owl, Sprague's pipit, and Baird's sparrow. Each of these species are addressed in this chapter.

Colonial Nesting Birds

Colonial nesting birds are migratory species which nest in concentrated groups. Within the planning area, colonial nesting bird species include great blue herons, double-crested cormorants, American white pelican, black-crowned night-heron, white-faced Ibis, Franklin's gull, Caspian tern, Forster's tern, common tern, and black tern.

Great blue herons and double-crested cormorants build nest in the tops of large trees and in general next to major rivers or reservoirs. These nesting colonies are often referred to as rookeries. Great plains cottonwood adjacent to the Missouri, Yellowstone, Powder, and Tongue rivers are the preferred nesting habitat for these species. Most riparian habitat adjacent to major rivers being privately held, and therefore the majority of the rookeries are located on non-BLM administered surface. The number of known rookeries on BLM is estimated at less than five for the entire planning area.

Other colonial nesting birds nest on islands within large lakes or wetlands and in some lesser instances on islands within the Yellowstone and Missouri Rivers. Within the planning area these islands are primarily located north of the Missouri River an on non-BLM administered lands.

SPECIAL STATUS SPECIES (AQUATICS, AVIAN AND TERRESTRIAL)

Special status species include:

- species proposed for listing, listed as threatened or endangered, or candidates for listing under the provisions of the ESA;
- species listed by a state in a category such as threatened or endangered, implying potential endangerment or extinction; and
- those designated sensitive species by a BLM State Director (*Draft Montana/Dakotas Special Status Species; May 2014)*.

As referenced in the BLM Manual 6840, conservation of special status species means the use of all methods and procedures necessary to improve the condition of special status species and their habitats to a point where special status recognition is no longer warranted.

The BLM coordinates threatened and endangered species management with the USFWS and MFWP. The BLM initiates Section 7 consultation with the USFWS before approving or implementing any action that may affect listed species or designated critical habitat. Streamlined consultation procedures detailed in the July 27, 1999 Memorandum of Agreement and subsequent implementation guidance for Section 7 consultations are utilized to provide collaborative opportunities in the consultation process. The BLM has entered into a MOU with the USFWS to improve the efficiency and effectiveness of RMP-level Section 7 consultation processes under the ESA. Through this MOU, the BLM agrees to promote the conservation of candidate, proposed, and listed species and to consult informally and formally on listed and proposed species (and designated and proposed critical habitat) during planning to protect and improve the condition of species and their habitats to a point where their special species status is no longer necessary.

Federally listed species may have habitat considered crucial to species viability. For those listed species without critical habitat designation, the BLM cooperates with the USFWS to determine and manage important habitats.

Protective measures for migratory birds are provided in accordance with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668–668d), as well as guidance described in the *Fish, Aquatic and Wildlife Habitat, Including Special Status Species Appendix*. Other fish and wildlife resources are addressed under the Fish and Wildlife Coordination Act of 1934 (16 U.S.C. 661 et seq.).

Most management would be directed at habitat maintenance or improvement. Actions which improve individual special status species habitats or populations, would be considered and implemented where appropriate.

If species occurring on BLM-administered lands are designated as threatened and endangered by the USFWS, management actions would be developed to conserve, enhance, and protect the species in accordance with the ESA.

Numerous migratory bird species are BLM Sensitive Species (Table 3-18) and are therefore a special status species. Included are USFWS Birds of Conservation Concern, which have been identified as species that, without additional conservation actions, are likely to become candidates for listing under the ESA and are in greatest need of conservation action.

SPECIAL STATUS SPECIES – AQUATICS AND INVERTEBRATES

There is one federally endangered fish species (pallid sturgeon) and four special status fish species (including the Iowa darter, sauger, sturgeon chub, and paddlefish) occurring in the planning area (Table 3-16).

TABLE 3-16.
SPECIAL STATUS AMPHIBIANS, REPTILES, FISH, AND INVERTEBRATE SPECIES KNOWN OR LIKELY TO OCCUR IN THE PLANNING AREA

Amphibians	
Species	**Habitat Types**
Great Plains Toad	Glacial potholes, stock reservoirs, irrigation ditches, and small coulees (Werner et al. 2004). During the non-breeding season, adjacent upland habitat
Plains Spadefoot	Ponds, predominantly those temporary in nature, and surrounding areas with sandy or gravelly loam soils
Reptiles	
Species	**Habitat Types**
Snapping Turtle	Large rivers and streams, lakes, ponds, and marshes
Spiny Softshell Turtle	Missouri and Yellowstone rivers and their tributaries, and reservoirs
Greater Short-Horned Lizard	Sagebrush and short-grass prairie, particularly south-facing slopes, rocky coulee rims, and shale outcrops (Werner et al. 2004)
Milksnake	Grasslands and adjacent riparian areas, rocky outcrops, riparian zones, juniper hillsides, and margins of agricultural fields (Werner et al. 2004)
Western Hog-nosed Snake	Wet meadows and dense vegetation in the most northeastern portion of Montana
Fish	
Species	**Habitat Types**
Paddlefish	Yellowstone and Missouri Rivers and larger tributaries
Sauger	Rivers and their tributaries and Ft. Peck Lake
Iowa Darter	Small prairie streams
Sturgeon Chub	Yellowstone, Powder and Missouri Rivers and their larger tributaries
Pallid Sturgeon	Yellowstone and Missouri Rivers
Invertebrate	
Species	**Habitat Types**
A Mayfly	Associated with the Powder River drainage

USFWS listed the pallid sturgeon as an endangered species in 1990. Historic range included the Missouri River and the lower reaches of the Yellowstone River. The current distribution is the Missouri River (downstream of Fort Peck Dam) and the Yellowstone River (downstream of the Cartersville Diversion Dam near Forsyth). Montana populations appear to contain old, large fish with no recent evidence of successful reproduction.

Although critical habitat is not designated for pallid sturgeon, they prefer large, swift, turbid, and relatively warm free-flowing rivers. In Montana, the pallid sturgeon inhabits water with temperatures ranging from 32° to 86°F and during the summer, water depths from 4 to 12 feet before moving to deeper water during the winter.

The pallid sturgeon is most frequently captured over sand substrate in the Missouri River, but have also been caught over gravel and rock substrate in the Yellowstone River. After spawning, free-floating larvae drift a substantial distance downstream for at least several days, leaving larvae subject to predation. Basic parameters such as spawning location, substrate preference, water temperature, and seasonal activity have been poorly documented.

Pallid Sturgeon

Preventing extinction through the establishment of three captive broodstock populations in separate hatcheries is an immediate MFWP goal but the long-term objective is downgrading and eventual delisting of the species. Protection and habitat restoration is focused in six recovery areas, two of which are in Montana: the Missouri River above Fort Peck Reservoir and the lower reaches of the Yellowstone and Missouri rivers below the Fort Peck Dam. Habitat restoration can only be achieved through restoration of specific habitats in the Yellowstone and Missouri rivers through restoration of river flows and proper temperature and turbidity.

SPECIAL STATUS SPECIES - MAMMALS

There are six special status mammal species in the planning area. This includes five BLM sensitive species and, one USFWS designated endangered species (black-footed ferret), (Table 3-17).

Black-footed ferrets

Black-footed ferrets rely on the prairie dogs as a food source and habitat. As stated in the table above, there are no known naturally occurring black-footed ferrets on BLM-administered lands. In addition, there is limited probability that ferrets reintroduced on the Northern Cheyenne Reservation would access BLM-administered lands due to the geographical constraints and the limited connectivity required for functional habitat.

TABLE 3-17.
SPECIAL STATUS WILDLIFE SPECIES KNOWN
OR LIKELY TO OCCUR IN THE PLANNING AREA

MAMMALS	
Species	**Habitat Type**
Black-Footed Ferret	Prairie dog colonies. Introduced population on Northern Cheyenne Reservation. Not known to occupy any BLM-administered lands.
Black-Tailed Prairie Dog	Occur in grassland and shrub grassland habitat. Prairie dogs are associated with slopes of 0 to 4 percent (Proctor, Beltz, and Haskins 1998).
Swift Fox	Large unfragmented short and mid-grass prairies.
Pallid Bat	Availability of suitable roosting sites (e.g., tree cavities, tree bark, caves, rock crevices, mines, and buildings) are key habitat components for these bats (Nagorsen and Brigham 1993).
Northern Myotis	
Townsend's Big-eared Bat	
Spotted Bat	
Fringed Myotis	

The connectivity currently required to provide for functional black-footed reintroduction habitat is defined as a series prairie dog complexes (i.e. sub-complexes) no further than 1.5 km of each other and comprise at least 1,500 acres of total habitat (Biggens 1993, Biggens et al. 2006). Internal BLM GIS analysis of all available data (all years combined regardless of colony activity) determined the planning area may have seven potential complexes of 1500 acre or greater; although none exist across one contiguous block of public lands. Percent BLM ownership within the complexes identified include approximately 49%, 20%, and the remainder 3% or lower.

Historical data was used for the GIS analysis and therefore does not contain the current size status of the prairie dog colonies. The size and status (e.g., active or inactive) of prairie dog colonies is fluctuating in the planning

area primarily due to sylvatic plague. Therefore, recent plague events throughout the planning area have likely reduced the ability of some potential complexes to meet the minimum size criteria for successful black-footed ferret establishment. One of the greatest threats to prairie dog viability and black-footed ferret recovery is sylvatic plague. Black-footed ferrets are known to be directly susceptible to the disease, and nonepizootic levels of plague transmission appear to cause substantial mortality in prairie dogs and black-footed ferrets (Biggins, et. Al, 2011).

Although black-footed ferrets are not known to exist in the planning area, outside of the Northern Cheyenne Reservation, the BLM cooperates with the Montana Prairie Dog/Black-footed Ferret Working Group to assess the potential for black-footed ferret reintroduction sites. Recent cooperative efforts by the working group to investigate potential black-footed ferret reintroduction areas includes NAIP imagery and ground truth analysis (Maxell 2010); assessment of selected potential complexes by MFWP for reintroduction suitability; and on the ground mapping and assessment of several potential complexes (Knowles, 2012). These efforts to date have not identified black-footed ferret habitat areas within the planning area as conducive to re-introduction, without further augmentation of habitat and/or working with willing neighboring private landowners. BLM continues to cooperate with the Montana Prairie Dog/Black-footed Ferret Working Group to identify any future re-introduction opportunities.

Black-Tailed Prairie Dogs

Numerous wildlife species (e.g. burrowing owls, mountain plovers, and ferruginous hawks) depend on black-tailed prairie dog habitat. Therefore, the decline in prairie dog habitat from control, fragmentation, and plague may cause secondary declines to other wildlife species. The viability of the associated species hinges on maintaining viable prairie dog habitat throughout its range.

Black-tailed prairie dog colonies occupy approximately 39,800 acres, which includes Northern Cheyenne Tribal lands in the planning area. Black-tailed prairie dog colonies on BLM-administered lands is estimated at approximately 10,500 acres. These estimates are based on a combination of the most recent surveys (Knowles 2004) available from 2003 to 2004; however, prairie dog colonies are subject to frequent fluctuations in size and population densities.

SPECIAL STATUS SPECIES – AVIAN

There are 31 avian special status species in the planning area (Table 3-18). This includes 24 BLM sensitive avian species, two USFWS designated endangered avian species (interior least tern and whooping crane), one USFWS designated threatened avian species (piping plover), and four USFWS designated candidate species (greater sage-grouse, Sprague's pipit, red knot, yellow-billed cuckoo). A separate discussion is provided for the USFWS designated endangered, threatened, and candidate species in this section. In addition, bald and golden eagles are discussed further due to the habitat management responsibility contained within the Bald and Golden Eagle Protection Act.

Interior Least Tern

Interior least terns *(Sterna antillarum)* migrate through the planning area, in the spring and fall; nesting habitat includes gravel islands associated with large rivers. Interior least terns have been reported associated with the Yellowstone River below Miles City, near the eastern portion of Fort Peck Reservoir and along the Missouri River below Fort Peck Dam (Atkinson and Dood 2006a; MFWP and MNHP 2006). Of the 129,500 acres of least tern nesting habitat, 1,373 BLM surface acres, 7,420 BLM-administered minerals (subsurface) and 5,778 oil and gas acres (subsurface) are found within the planning area.

Whooping Crane

The whooping crane (*Grus americana*) was classified an endangered species in 1967. The main cause of the species' decline was conversion of pothole and prairie habitat for agriculture (USFWS 2005b). Continued threats to the birds include susceptibility to natural events (e.g., short, ice-free season in the northern breeding grounds, and severe weather during migration and wintering). The whooping crane occurs as a transient or

TABLE 3-18.
SPECIAL STATUS AVIAN SPECIES KNOWN
OR LIKELY TO OCCUR IN THE PLANNING AREA[1]

Species	Habitat Type
American Bittern	Large wetlands dominated by emergent vegetation, where they mostly select the shallow periphery for nesting and feeding (Montana Partners in Flight 2000).
Baird's Sparrow	Grasslands, particularly native prairie (Montana Partners in Flight 2000)
Black-backed Woodpecker	Commonly associated with early successional. burned forest, of mixed conifers, including ponderosa pine woodland and savanna.
Brewer's Sparrow	Predominantly sagebrush (MNHP et al. 2006; MNHP and MFWP 2006)
Burrowing Owl	Open grasslands and use abandoned mammal burrows (primarily prairie dog and badger) for nesting (MFWP and MNHP 2006)
Caspian Tern	Found breeding on large lakes, reservoirs, and perhaps rivers. Nest sites are typically on rocky or sandy islands; in other areas, beaches are occasionally used (Montana Partners in Flight 2000).
Chestnut-Collared Longspur	Native grasslands and hayfields, usually avoiding cultivated fields (Montana Partners in Flight 2000).
Common Tern	Islands in large lakes or reservoirs are favored breeding grounds (Montana Partners in Flight 2000).
Ferruginous Hawk	Grasslands, sagebrush, and other grass-shrub lands –breeding habitat
Franklin's Gull	Widely distributed in Montana during migration. No documented breeding in FO in nearly 30 years (Montana Partners in Flight 2000).
Loggerhead Shrike	Use a wide variety of open habitats (e.g., sagebrush shrubland and shrub-steppe, grasslands, badlands, pastures, and agricultural fields with scattered trees or shrubs for nesting), as long as woody nesting strata (often thorny shrubs) are available
Long-Billed Curlew	Agricultural fields as stopover sites during migration but breeding habitat consists primarily of native grasslands
McCown's Longspur	Grasslands with low vegetation cover, such as true native short-grass prairie or heavily grazed mixed-grass prairie (Montana Partners in Flight 2000); but the species may also use cultivated lands.
Mountain Plover	Relatively flat sites with short grass and scattered cactus, as well as high, arid plains and shortgrass prairie with blue grama-buffalo grass communities. Also utilizes prairie dog habitat.
Peregrine Falcon	Prefer large cliffs for nesting, in association with a wide variety of coniferous forest types. (Montana Partners in Flight 2000).
Red-headed Woodpecker	Inhabit open and park like areas of forest. Species required many snags, lush ground cover, and open canopy. Found primarily along major rivers within the associated riparian forest. They are also present in open savannah country as long as adequate ground cover, snags and canopy cover can be found. Large burns are also utilized (Montana Partners in Flight 2000).
Sage Thrasher	Prefer relatively dense stands of tall sagebrush for nesting
Veery	Present in cottonwood riparian forest increases with patch size (Montana Partners in Flight 2000).
White-faced Ibis	Closely associated with shallow wetlands with emergent vegetation or islands of emergent vegetation. Colonies are limited to permanent wetlands (Montana Partners in Flight 2000).

[1]For special status species Interior Least Tern, Whooping Crane, Piping Plover, Sprague's Pipit, Red Knot, Greater Sage-Grouse, Bald Eagle, and Golden Eagle, see discussion in this section - Special Status

migrant species and does not breed in Montana (MFWP and MNHP 2006). Data on whooping cranes in the state are rare. Sightings of the birds have generally been in marshy areas and stubble and grain fields (MFWP and MNHP 2006). Whooping cranes have not been recently documented since prior to 2006 in the planning area (MNHP, MFWP, and Montana Audubon Society 2006).

Piping Plover

In Montana, piping plovers *(Charadrius melodus)* are known to nest in the northern and northeastern portion of the state, specifically adjacent to Fort Peck and Nelson Reservoirs, Bowdoin National Wildlife Refuge, Alkali

Lake, the Medicine Lake National Wildlife Refuge, and the Missouri River below Fort Peck Dam (MFWP and MNHP 2006). Of the approximately 135,000 acres of piping plover habitat mapped, approximately 730 acres are located on BLM-administered land. Surveys have historically documented one piping plover nesting and brood-rearing area on BLM-administered lands. This 16-acre area is located in Sheridan County.

In 2002, the USFWS designated critical habitat (92,532 acres in the planning area in four separate units) for the Northern Great Plains breeding population of piping plover (USFWS 2002a); approximately 507 acres of BLM-administered surface and 8,042 BLM-administered mineral (subsurface) acres of the total acreage occurs on BLM-administered lands.

Within the planning area, there are three units of designated critical habitat:

- MT-1, which includes 20 alkali lakes and wetlands in Sheridan County;
- MT-2, which includes the Missouri River from just west of Wolf Point, to the North Dakota boundary; and
- MT-3, which includes areas near Fort Peck Reservoir.

Sprague's Pipit

The Sprague's pipit *(Anthus spragueii)* selects prairies with grasses of intermediate height and may require relatively large blocks (approximately 170 acres in a study in Saskatchewan) of suitable habitat (MFWP and MNHP 2006). Main threats to the species include habitat loss and alteration caused by agriculture and overgrazing (MNHP et al. 2006). Sprague's pipits were found warranted, but precluded for listing as a threatened or endangered species (USFWS 2010b). Although Sprague's pipits are rarely found in cropland or CRP land, they have been found to use nonnative planted grassland (USFWS 2010b). The USFWS (2010b) reports that pipit occurrence may be better predicted using vegetation structure rather than composition. Sprague's pipits have been documented in Daniels, Sheridan, Roosevelt, McCone, Richland, Dawson, Prairie, Custer, and Fallon counties (MNHP et al. 2006). BLM biologists have observed Sprague's pipits in Carter and Prairie counties. Historical observations have also been documented for Wibaux and Big Horn counties (Lenard, Carlson, Ellis, Jones, and Tilly 2003).

Red Knot

The red knot *(Calidris canutus)* was once the most numerous shorebirds in North America, but during the 1800s and early 1900s it was put under severe hunting pressure on its migratory route. The red knot was listed as a Candidate Species in 2006. The USFWS determined on September 30, 2013 that the red knot warranted Proposed Threatened status with a final decision scheduled for some time in 2014. The red knot has been observed rarely during migration at Medicine Lake National Wildlife Refuge, Goose Lake Waterfowl Production Area, and Round Lake, all located in the extreme northeastern corner of Montana. Other limited observations also occur near Fort Peck Lake and Rosebud County. The most recent observation was in 2009 at Round Lake, Sheridan County, Montana. Very few observations occur and no nesting or breeding occurs in the planning area.

Yellow-Billed Cuckoo

One sighting of this species in association with surveys conducted for the Tongue River railroad proposal (2013), was documented adjacent to the Tongue River. Yellow-billed cuckoos are associated with thick cover (trees and shrubs) and willow habitat associated with streams and rivers.

Bald Eagle

On June 28, 2007, the bald eagle (*Haliaeetus leucocephalus*) was removed from the federal list of threatened species, but bald eagles remain protected via the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. In the western United States, bald eagle abundance has steadily increased in recent years (USFWS 1999b). Bald eagles generally are found throughout the planning area, but concentrate along rivers and lakes with abundant fish and waterfowl and large trees for nesting and roosting. During spring and fall

migration and winter, bald eagles use the Yellowstone, Missouri, Tongue, Musselshell, and Powder rivers and wintering bald eagle use is particularly high at the Fort Peck Reservoir (MFWP and MNHP 2006).

Golden Eagle

Golden eagles *(Aquila chrysaetos)* nest on cliffs and in large trees but forage over open areas such as grasslands and open woodlands (MNHP and MFWP 2006) and are frequently observed throughout the planning area.

Twenty-six golden eagle nest sites are documented on BLM-administered land, with 171 reported across all ownerships. The number of active nests is unknown.

Greater sage-grouse

Greater sage-grouse are a BLM sensitive species and a USFWS designated candidate species. This section discusses greater sage-grouse in relationship to general information, management zone information, habitat delineation and classifications, conservation plans and strategies, and predation relationships.

General Information

Greater sage-grouse are a native species and occupies habitat across 11 Western states, including most of the planning area. This occupied habitat includes the sagebrush steppe of western North America and greater sage-grouse distribution closely follows that of sagebrush, primarily big sagebrush (Montana Sage Grouse Work Group 2005). In addition, to mature sagebrush, greater sage-grouse requires an understory of grasses and forbs. In eastern Montana, where close interspersion of wintering, nesting, breeding, and brood-rearing habitats rarely require large seasonal movements, greater sage-grouse are essentially non-migratory.

Management Zone Information

In order to provide relative discussion for a species that utilizes habitat on a landscape scale, the range-wide distribution of greater sage-grouse habitat was divided into seven management zones based on populations within floristic provinces (Stiver et al. 2006). The floristic provinces are areas with similar environmental factors which influence vegetation communities (Knick and Connelly 2011a). The planning area is all within Management Zone 1, which includes portions of Montana, North Dakota, South Dakota, Wyoming, Alberta and Saskatchewan (Figure 3-8).

In Management Zone 1, greater sage-grouse distribution was historically a function of the interaction of physical factors (e.g., climate, soils, vegetation, geology, and elevation), and natural disturbance factors (e.g., fire, grazing, and drought) that allowed sagebrush to persist on the landscape. These physical and natural factors combined to produce an interspersion of different habitats that included sagebrush plant communities favorable for greater sage-grouse occupation.

Planning Area Habitat Delineation and Management Classification

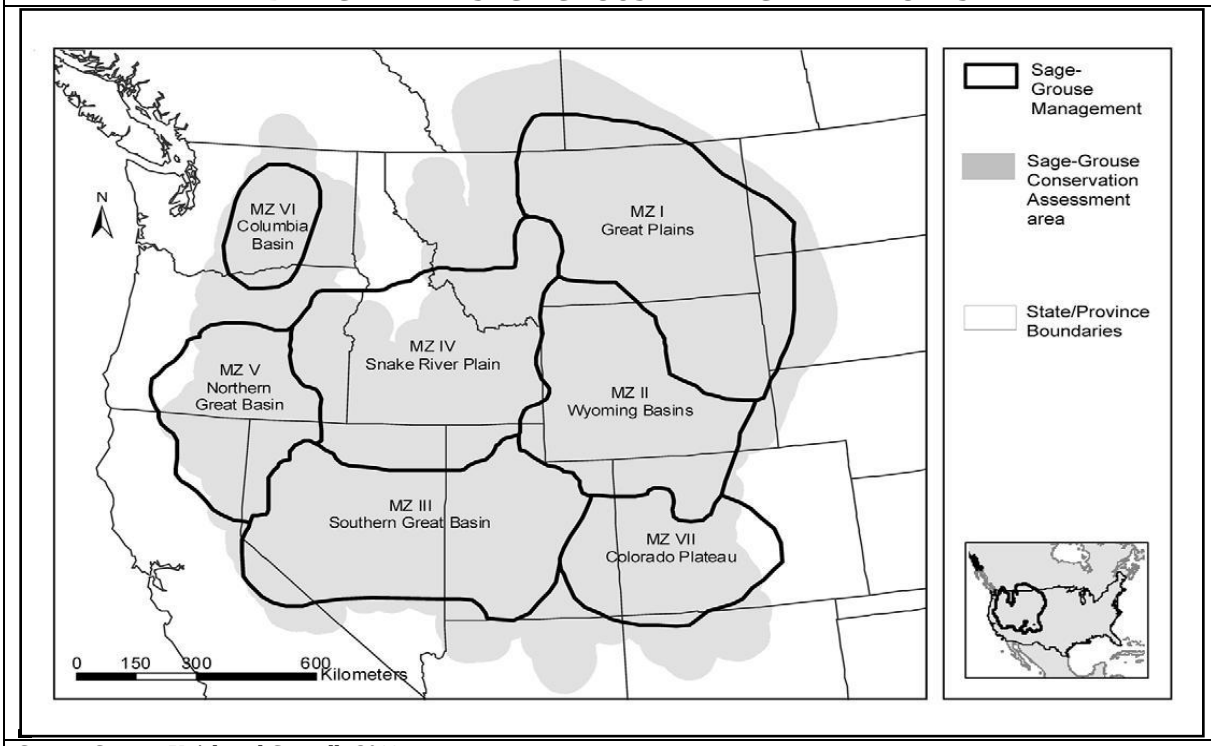
In cooperation with federal and non-governmental partners, MFWP delineated and classified greater sage-grouse habitat in Montana (see Map 2). The delineation process initially utilized male counts at leks from 2005 through 2007, to represent the overall greater sage-grouse population within an area. Additional factors considered included greater sage-grouse lek complexes and the associated habitat important for greater sage-grouse distribution (http://fwp.mt.gov/gisData/metadata/sgcore.htm).

The outcome of this delineation was the release of spatial data that provided delineation of greater sage-grouse general habitat and core habitat. General habitat is simply areas providing habitat for greater sage-grouse, but are not within core habitat. Greater sage-grouse core habitat has the greatest number of displaying males (approximately 76% in Montana) and include the associated breeding, nesting, brood rearing, and winter habitat for the species.

Although nonnative habitats exist within general and core habitat and not all habitats within these areas are sagebrush habitat, these designations provide a landscape-level approach needed to maintain sustainable greater sage-grouse populations. Therefore, the data produced from the cooperative effort is intended for initial resource review or conservation planning and not for site specific planning and implementation. The planning area for the RMP revision contains approximately 12 million total surface acres of general greater sage-grouse habitat; and the seven greater sage-grouse core habitat areas containing approximately 3.8 million total surface acres (*MFWP metadata, dated January 22, 2014)*.

Utilizing the greater sage-grouse delineations outlined above, BLM utilized the process identified in Montana/Dakota's BLM Instruction Memorandum (IM No. MT-2010-017) to further classify MFWP core habitat as priority or restoration area for greater sage-grouse management. Some of the factors considered in the reclassification process included valid existing rights, existing disturbances, and foreseeable development based on the valid existing rights.

FIGURE 3-8.
BLM GREATER SAGE-GROUSE MANAGEMENT ZONES



Source: Source: Knick and Connelly 2011a

The outcome of this effort resulted in the classification of four core habitat areas (Carter, North Rosebud, Decker, and Garfield-McCone) as priority areas and three core habitat areas (Cedar Creek, South Carter, and West Decker) as restoration areas (See Map 4). Discussion on each of the protection and restoration areas and the general habitat area can be found in Tables 3-19 and 3-20.

BLM, MFWP and others have long cooperated to inventory habitat for new greater sage-grouse leks, as well as validating and updating information on known leks. MFWP maintains information specific to leks and is the "official" repository of this information. While information specific to the number of leks is provided below, it should be noted the number of greater sage-grouse leks is ever changing. As a result of cooperative efforts, new leks are identified and validation of existing data continues to result in the refinement of the lek database.

General Habitat Area

General habitat includes greater sage-grouse habitat outside of priority and restoration areas. In review of MFWP lek data, there are 353 greater sage-grouse leks within general habitat. Of this, 45 leks are located on BLM administered surface and an additional 36 leks are located on BLM administered mineral estate.

BLM administered lands comprised approximately 12% of the total surface area in general habitat. BLM administered mineral estate comprises approximately 41% of the area; with BLM administered oil and gas mineral estate being approximately 24% of the area. Approximately 17% of the BLM administered oil and gas estate is currently leased. The remaining surface ownership within the general habitat area is either private (68%) or a combination of other ownership (20%).

The largest resource use in the general habitat area is production agriculture (livestock grazing and cropland), with approximately 40% of the area being converted from native vegetation to cropland. Other resources uses include coal mining activity (less than .01% of the area) and oil and gas development (less than .01% existing direct disturbance). Over the past 33 years, approximately 3% of the area has been impacted by documented wildland fire events.

Carter Priority Area

The Carter Priority Area (approximately 1.1 million total acres) is located in the far southeast corner of the planning area, primarily in Carter County, extending into Powder River County. There are 143 greater sage-grouse leks within the Carter Priority Area (MFWP data), including 73 leks on BLM administered surface and an additional 32 leks on BLM administered mineral estate.

BLM administers approximately 38% of the total surface area and BLM administered minerals, including the oil and gas mineral estate comprises approximately 64% of the area. Approximately 3% of the BLM administered oil and gas estate is currently leased. The remaining surface ownership within the area is either private lands (51%) or a combination of state, county, or other federal agencies (11%).

The largest resource use in the Carter Priority Area is production agriculture (livestock grazing), with approximately 4% of the area converted from native vegetation to cropland. Other resources uses include infrastructure (rights-of-ways [ROWs] and transportation) and oil and gas development (less than 0.001% existing direct disturbance). Over the past 33 years, approximately 2% of the area has been impacted by documented wildland fire events.

The Carter Priority Area was the focus of a greater sage-grouse cooperative research effort by Region 7-MFWP and the BLM – MCFO. The summarization of this effort is contained in a report entitled *Greater Sage-Grouse in Southeast Montana Sage-Grouse Core Area* (*Greater Sage-Grouse in the Southeast Montana Sage-Grouse Core Area, Montana Fish, Wildlife and Parks, 2014*). The researchers used radio telemetry to quantify the demographic rates, seasonal movements, and seasonal habitat uses of 94 greater sage-grouse hens. The report suggests greater sage-grouse will continue to persist at sustainable levels in the Carter Priority Area unless catastrophic events (e.g., disease outbreaks) occur and provided the quality and extent of greater sage-grouse habitat is maintained or improved.

North Rosebud Priority Area

The North Rosebud Priority Area (approximately 1.8 million total acres) is located on the western edge of the planning area, primarily in Rosebud County, extending into southern Garfield County. There are 213 greater sage-grouse leks within the North Rosebud Priority Habitat Area (MFWP data), including 18 leks on BLM administered surface and an additional 11 leks on BLM administered mineral estate.

TABLE 3-19
BLM ADMINISTERED SURFACE AND MINERAL ESTATE RESOURCE
SUMMARY FOR GREATER SAGE-GROUSE GENERAL, PRIORITY, AND RESTORATION AREAS

	General	Carter Priority	North Rosebud Priority	Decker Priority	Garfield McCone Priority	Cedar Creek Restoration	South Carter Restoration	West Decker Restoration	Total
Total Acres	11,955,182	1,111,871	1,822,610	77,731	570,061	62,813	245,080	28,258	15,873,606
BLM Administered Surface Acres (% of Tot)[1]	1,440,558 (12%)	422,968 (38%)	171,482 (9%)	5,002 (6%)	217,761 (38%)	20,317 (32%)	64,067 (26%)	2,901 (10%)	2,345,156 (15%)
Private Surface Acres (% of Tot)[1]	8,104,852 (68%)	566,780 (51%)	1,530,508 (84%)	67,725 (87%)	253,763 (45%)	39,874 (63%)	169,297 (69%)	23,194 (82%)	10,755,993 (68%)
BLM Administered Mineral Acres (% of Tot)	4,646,622 (39%)	716,264 (64%)	245,491 (13%)	73,929 (95%)	359,041 (63%)	21,991 (35%)	170,810 (70%)	23,588 (83%)	6,257,736 (39%)[2]
BLM Administered Oil & Gas Acres (% of Tot)	2,666,219 (22%)	713,721 (64%)	237,898 (13%)	56,135 (72%)	379,039 (66%)	21,991 (35%)	164,654 (67%)	11,262 (40%)	4,250,919 (27%)[3]
BLM Administered Mineral Material Acres[2] (% of Tot)	2,621,028 (22%)	705,583 (63%)	216,791 (12%)	55,757 (72%)	319,213 (56%)	20,297 (32%)	160,989 (66%)	11,151 (39%)	4,110,809 (26%)
BLM Administered Coal Ac (% of Tot)	4,538,739 (38%)	707,861 (64%)	229,979 (13%)	73,929 (95%)	358,711 (63%)	20,297 (32%)	154,834 (63%)	23,588 (83%)	6,107,938 (38%)
BLM Administered Locatable Acres (Open)[3] (% of Tot)	950,576 (8%)	418,455 (38%)	163,758 (9%)	5,002 (6%)	216,293 (38%)	19,128 (30%)	62,496 (26%)	2,583 (9%)	1,838,291 (12%)

[1] BLM & private lands comprise 83% of all greater sage-grouse habitat. State, Indian, USFS, USDA, USFS and other comprise the remaining 17%.
[2] Mineral Material in the MCFO typically is limited to sand and gravel
[3] Locatable Minerals has historically been limited to bentonite.

TABLE 3-20
BLM ADMINISTERED SURFACE AND SUBSURFACE ESTATE RESOURCE USE SUMMARY FOR GENERAL, PRIORITY, AND RESTORATION AREAS

	General	Carter Priority	North Rosebud Priority	Decker Priority	Garfield McCone Priority	Cedar Creek Restoration	South Carter Restoration	West Decker Restoration	Total
Non-BLM Crop Ac (2012)[1]	4,826,120	42,260	10,244	259	7,473	656	8,149	25	4,895,186
Exist. Coal Mine Acres[2]	43,816	0	0	0	0	0	0	3,007	46,823
Federal Acres	26,851							2,895	29,746
BLM ROW Acres	4,153	1,685	206	26	629	407	536	8	7,650
Tot O&G RFD High Acres	2,165,267	115,643	0	17,209	0	0	37,010	0	2,335,129
-Fed O&G Ac	428,744	61,298	0	11,031	0	0	26,944	0	528,017
Tot O&G RFD Med Acres	6,800,945	189,112	211,895	60,522	55,814	62,813	147,938	28,258	7,557,297
-Federal O&G Acres	679,004	29,902	13,849	45,105	22,638	21,991	115,490	11,262	1 ,039,241
Tot O&G RFD Low Acres	2,990,325	807,813	1,610,716	0	514,248	0	59,614	0	5,982,716
-Federal O&G Acres	1,765,465	522,924	224,050	0	356,401	0	20,011	0	2,888,851
Fed O&G Acres Leased	483,220	20,018	61,150	40,139	22,916	20,244	18,909	9,006	675,602
-% of Tot Federal O&G Acres	(17%)	(3%)	(26%)	(72%)	(6%)	(92%)	(12%)	(80%)	(15%)
Tot Active O&G Wells	2,248	8	237	63	0	852	21	22	3,451
-Federal Wells	635	7	11	4	0	255	17	14	943
Tot O&G Wells Drilled	5,088	187	1,022	81	27	1,007	116	173	7,701
-Federal Wells Drilled	1,229	120	68	17	17	314	90	30	1,885
Init Dist Ac All Wells	9,054	200	1,763	70	32	1,631	128	149	13,027
-Federal Wells	2,234	126	119	17	21	522	101	25	3,165
RFD Coal Acres	62,521	0	0	0	0	0	0	3,943	66,464
-Federal Acres	2,335	0	0	0	0	0	0	3,943	6,278
RFD Locatables[3]	865	0	0	0	0	0	32,915	0	33,780
-BLM Acres	0	0	0	0	0	0	22,331	0	22,331
BLM Mineral Material Acres[4]	89	9	0	0	0	0	0	0	98
Mining Claim Acres	2	0	161	0	0	0	24,084	0	24,247
-BLM Acres	2	0	0	0	0	0	13,991	0	13,993
Documented Fire Acres[5]	372,389	17,734	5,265	7,282	1,397	0	1,369	0	405,436
-BLM Acres	42,787	10,323	290	0	408	0	74	0	53,882

[1] 2012 National Agricultural Statistics Service Cropland Data Layer. Published crop-specific data layer [Online]. Available at http://nassgeodata.gmu.edu/CropScape/ (accessed 2014). USDA-NASS, Washington, DC.
[2] Includes active mine area, areas reclaimed, but not released from bond liability and areas in which permits have been granted or applied for, but not yet developed.
[3] Includes bentonite and uranium
[4] Mineral Material in the MCFO typically is limited to sand and gravel
[5] Documentation started in 1980 and data set is through 2013.

BLM administers approximately 9% of the total surface area and BLM administered mineral estate, included the oil and gas mineral estate comprises approximately 13% of the area. Approximately 26% of the BLM administered oil and gas estate is currently leased. The remaining surface ownership within the area is either private lands (84%) or a combination of other ownership (7%).

The largest resource use in the North Rosebud Priority Area is production agriculture (livestock grazing), with less than 1% of the area having been converted from native vegetation to cropland. Other resources uses include infrastructure (ROWs and transportation) and oil and gas development (less than 0 .001% existing direct disturbance). Over the past 33 years, less than 1% of the area has been impacted by documented wildland fire events.

Decker Priority Area

The Decker Priority Area (approximately 78,000 total acres) is located in the southwestern portion of the planning area in eastern Big Horn County, extending into southwestern Powder River County. There are 24 greater sage-grouse leks within the Decker Priority Habitat Area (MFWP data), including one lek on BLM administered surface and an additional 12 leks on BLM administered mineral estate.

BLM administers approximately 6% of the total surface area and BLM administered mineral estate comprises 96% of the area; with BLM administered oil and gas mineral estate including 72% of the area. Approximately 72% of the BLM administered oil and gas estate is currently leased. The remaining surface ownership is either private lands (87%) or a combination of other ownership (7%).

The largest resource use in the Decker Priority Area is production agriculture (livestock grazing), with less than 0.01% of the area being converted from native vegetation to cropland. Other resources uses include infrastructure (ROWs and transportation) and oil and gas development (less than 0.001% existing direct disturbance). Over the past 33 years, approximately 9% of the area has been impacted by documented wildland fire events.

Garfield-McCone Priority Area

The Garfield-McCone Priority Area (approximately 570,000 total acres) is located in the northwestern portion of the planning area in eastern Garfield County and western McCone County. There are 63 greater sage-grouse leks within the Garfield-McCone Priority Area (MFWP data), including 22 leks on BLM administered surface and an additional 15 leks on BLM administered mineral estate.

BLM administers approximately 38% of the total surface area and BLM administered mineral estate comprises 73% of the area; with BLM administered oil and gas mineral estate including 63% of the area. Approximately 6% of the BLM administered oil and gas estate is currently leased for potential development. The remaining surface ownership is either private lands (45%) or a combination of state, county, or other federal agencies (17%).

The largest resource use in the Garfield-McCone Priority Area is production agriculture (livestock and cropland), with approximately 1% of the area being converted from native vegetation to cropland or introduced vegetative species. Other prevalent resource use includes infrastructure (ROWs and transportation). Over the past 33 years, less than 0.01% of the area has been impacted by documented wildland fire events.

Cedar Creek Restoration Area

The Cedar Creek Restoration Area (approximately 63,000 total acres) is located on the eastern portion of the planning area in eastern Fallon County and is within one of the oldest oil and gas fields in Montana (see Cedar Creek Anticline Discussion in *Minerals Appendix*). There are 33 greater sage-grouse leks within the Cedar Creek Restoration Area (MFWP data), including 14 leks on BLM administered surface and an additional one leks on BLM administered mineral estate.

BLM administers approximately 32% of the total surface and BLM administered mineral estate comprises 69% of the area; with BLM administered oil and gas mineral estate including 66% of the area. Approximately 92% of the BLM administered oil and gas estate is currently leased and a vast majority is held through production. The remaining surface ownership is either private lands (63%) or a combination of other ownership (5%).

The two largest resources use in the Cedar Creek Priority Area is production agriculture (livestock grazing), and oil and gas development. Other prevalent resource use includes infrastructure (ROWS and transportation). There are currently 852 producing oil and gas wells in the area, which equates to approximately one oil and gas well for every 73 acres. Over the past 33 years, none of the area has been impacted by documented wildland fire events.

West Decker Restoration Area

The West Decker Restoration Area (approximately 28,000 total acres) is located on the southwestern portion of the planning area in eastern Big Horn County. There are 11 greater sage-grouse leks within the West Decker Restoration Area (MFWP data), including one lek on BLM administered surface/mineral estate.

BLM administers approximately 10% of the total surface area and BLM administered mineral estate comprises 83% of the area; with BLM administered oil and gas mineral estate including 40% of the area. Approximately 80% of the BLM administered oil and gas estate is currently leased. The remaining surface ownership is either private lands (82%) or a combination of other ownership (8%).

The two largest resources use in the West Decker Restoration Area is production agriculture (livestock grazing), and coal mining. Other prevalent resource use includes infrastructure (ROWs and transportation). There is active coal mining in the area, comprising 3,000 acres (9% of the area) of lands either being actively mined, reclaimed by not released from bond liability, or areas in which permits have been granted or applied for but not yet developed. Over the past 33 years, none of the area has been impacted by documented wildland fire events.

South Carter Restoration Area

The South Carter Restoration Area (approximately 245,000 total acres) is located in the southeastern portion of the planning area in Carter County. There are 22 greater sage-grouse leks within the South Carter Restoration Area (MFWP data), including 14 leks on BLM administered surface and an additional seven leks on BLM administered mineral estate.

BLM administers approximately 26% of the total surface area and BLM administered mineral estate comprises 69% of the area; with BLM administered oil and gas mineral estate including 66% of the area. Approximately 12% of the BLM administered oil and gas estate is currently leased. The remaining surface ownership is either private lands (69%) or a combination of other ownership (5%).

The two largest resources use in the South Carter Restoration Area is production agriculture (livestock grazing), and bentonite mining. Other prevalent resource use includes infrastructure (ROWs and transportation). There is currently active bentonite mining ongoing, with approximately 24,000 acres (approximately 10% of the area) claimed under the Mining Law of 1872. As Amended. Over the past 33 years, less than 0.01% of the area has been impacted by documented wildland fire events

Conservation Strategies and Participatory Efforts

The BLM formally began focusing on the conservation of greater sage-grouse with the issuance of the *National Sage-grouse Conservation Strategy* (BLM 2004i). This effort was shorty followed by the state of Montana issuing the *Management Plan and Conservation Strategies for Sage Grouse in Montana* (Montana Sage Grouse Work Group 2005). Both of these strategies provided broad goals for greater sage-grouse conservation, management, and specific actions to accomplish goals.

Since the development of the national and Montana strategies, the BLM has been involved in or has received from other agencies various conservation planning documents, greater sage-grouse objective development documents, and land use planning guidance. The most notable documents are: *A Report on National Greater Sage-Grouse Conservation Measures* (NTT 2011), commonly referred to as the NTT Report, and the *Greater Sage-grouse (Centrocerus urophasianus) Conservation Objectives: Final Report* (USFWS 2013), commonly referred to as the COT Report.

As part of BLM's December 2011 *National Greater Sage-Grouse Land Use Planning Strategy* (Washington IM 2012-044), BLM's direction was to incorporate explicit objectives and adequate conservation measures into RMPs to conserve greater sage-grouse and potentially reduce the need to list. As a result of this direction, BLM released the NTT Report. This report provided a condensed listing of range-wide potential threats to greater sage-grouse and provided suggested management actions for consideration in the planning process and alleviation of those threats.

Finer scale description of threats to greater sage-grouse through the identification of Priority Areas of Conservation (PAC) was one product of the COT Report. The COT Report discusses greater sage-grouse populations and sub-populations within each WAFWA management zone and describes the threats facing each population. The identified PACs and associated greater sage-grouse priority or restoration priority areas in the planning area include:

- Dakotas PAC, includes the Cedar Creek Restoration Area
- Yellowstone Watershed PAC, includes the Rosebud Priority Area, McCone-Garfield Priority Area, Carter Priority Area, and South Carter Restoration Area
- Powder River Basin PAC, includes the Decker Priority Area and the West Decker Restoration Area.

The COT Report characterizes the threats to PACs as either present and widespread, present but localized, not known to be present, or unknown. The COT Report's categorization of threats is based on PAC risk assessments "according to the best available data at the time the report was produced" and recognized that "not all threats or conservation needs are known with certainty". The interaction between the COT Report and BLM's land use planning efforts is that BLM's management actions defined in the RMP are evaluated against the COT report by USFWS to evaluate if BLM's management actions eliminate or reduced threats.

Since the COT Report was completed at the PAC level and is being utilized for measuring the effectiveness of the RMP/EIS for the conservation of greater sage-grouse, the MCFO evaluated the COT Report threats based upon finer scale data, scientific research, and existing land status information for the BLM administered surface and subsurface estate. Based on the outcome of the evaluation, the MCFO refined the COT Report threats for the planning area. The MCFO identified threats applicable to the planning area are the focus of this RMP/EIS. The results of this effort for each of the PACs are contained in Tables 3-21 through 3-23.

TABLE 3-21
EVALUATION OF THREATS ON BLM ADMINISTERED
LANDS IN THE DAKOTAS PAC WITHIN THE PLANNING AREA

Threat	***Present and Widespread Threat*** ***BLM- MCFO Evaluation***	***Rationale for Variance from COT Report***
Isolated/Small Size Energy Infrastructure	Yes	No Variance.
Energy	Yes	No Variance
Fire	No	Zero acres of documented fire occurrence for the past 33 years.
Mining	No	Zero acres of claims and no active mines.
Threat	***Threat Present But Localized*** ***BLM-MCFO Evaluation***	***Rationale for Variance from COT Report***
Sagebrush Elimination	Yes	No Variance.

TABLE 3-21
EVALUATION OF THREATS ON BLM ADMINISTERED
LANDS IN THE DAKOTAS PAC WITHIN THE PLANNING AREA

Agriculture Conversion	No	Using 2012 data less than 1% of total area. Not an authorized use on BLM administered Lands in the sense of converting native vegetation to agricultural crops for sole purpose of increasing cropland production.
Weeds/Annual Grasses	No	See discussion in Chapter 3 Vegetation for research and modeling discussions illustrating not a factor in planning area.
Grazing	Yes	If present, localized. All BLM-administered lands meeting Standards for Rangeland Health. If BLM-administered lands were found to not be meeting rangeland health standards, BLM must take action prior to the next grazing season.

TABLE 3-22. EVALUATION OF THREATS ON BLM ADMINISTERED
LANDS IN THE YELLOWSTONE PAC WITHIN THE PLANNING AREA

Threat	***Present and Widespread Threat*** ***BLM-MCFO Evaluation***	***Rationale for Variance from COT Report***
Agriculture Conversion	No	Using 2012 data less than 2% of total area. Not an authorized use on BLM administered Lands in the sense of converting native vegetation to agricultural crops for sole purpose of increasing cropland production.
Weeds/Annual Grasses	No	See discussion in Chapter 3 Vegetation for research and modeling discussions illustrating not a factor in planning area.
Infrastructure	Yes	No Variance.
Grazing	No	See below discussion in *Threats Present But Localized.*
Threat	***Threat Present But Localized*** ***BLM-MCFO Evaluation***	***Rationale for Variance from COT Report***
Sagebrush Elimination	Yes	N/A – No Variance
Fire	No	Less than 1% of the area with documented fire occurrence in the past 33 years.
Conifers	Yes	No Variance.
Energy	No	Except for small area in North Rosebud Priority Area, energy development largely non-existent. Total of 22 federal wells within PAC.
Mining	Yes	Only applicable to the South Carter Restoration area with approximately 10% of the area with claims and active bentornite mining.
Recreation	No	No developed recreation facilities and all travel limited to existing roads and trails.
Grazing	Yes	If present, localized. 98% of BLM-administered lands meeting Standards for Rangeland Health and remaining 2% are progressing towards meeting standards. If BLM-administered lands are not meeting Rangeland Health Standards BLM must take action prior to the next grazing season.

TABLE 3-23
EVALUATION OF THREATS ON BLM ADMINISTERED LANDS IN THE POWDER RIVER BASIN PAC WITHIN THE PLANNING AREA

Threat	***Present and Widespread Threat*** ***BLM-MCFO Evaluation***	***Rationale for Variance from COT Report***
Weeds/Annual Grasses	No	See discussion in Chapter 3 Vegetation for research and modeling discussions illustrating not a factor in planning area.
Energy	Yes	No Variance.
Mining	Yes	Only applicable to the West Decker Restoration Area. Decker Priority Area has zero claimed or mined areas.
Infrastructure	Yes	No Variance.
Grazing	No	See below discussion in *Threats Present But Localized.*
Recreation	No	No developed recreation facilities and all travel limited to existing roads and trails.
Threat	***Threat Present But Localized*** ***BLM-MCFO Evaluation***	***Rationale for Variance from COT Report***
Sagebrush Elimination	Yes	No Variance.
Fire	Yes	Only applicable to the East Decker Priority Area. Zero acres of fire occurrence in the West Decker Restoration Area for the past 33 years.
Conifers	Yes	No Variance
Urbanization	No	No urban development present on the landscape within the PAC
Grazing	Yes	If present, localized. All BLM-administered lands meeting Standards for Rangeland Health. If BLM-administered lands are not meeting Rangeland Health Standards BLM must take action prior to the next grazing season.

Predation Relationship

Predation is one of five specific ESA listing criteria; however, the USFWS did not identify predation as a significant threat to greater sage-grouse populations in their 2010 decision to list the species as warranted for protection under the ESA. The USFWS acknowledged that increasing patterns of landscape fragmentation are likely contributing to increased predation and identified two areas, neither in Montana, where predators may be limiting greater sage-grouse populations because of intense habitat alteration and fragmentation. Despite the USFWS document stating that predation is not a significant threat to greater sage-grouse populations in Montana, the public remains concerned about the influence of predators on greater sage-grouse conservation.

Predators are part of the ecosystem and greater sage-grouse have always been a prey species. Predators that prey on greater sage-grouse tend to be general lists, taking prey opportunistically, but do not focus solely or preferentially on greater sage-grouse (Hagen 2011). Predators of greater sage-grouse are commonly coyote, red fox, American badger, bobcat, golden eagles, and several other species of raptors (Schroeder and Baydack 2001; Hagen 2011). Younger birds can also be taken by common ravens, northern harriers, ground squirrels, and weasels. Nest predators include coyote, American badger, common raven and black-billed magpie (Schroeder and Baydack 2001; Hagen 2011). Smaller predators of greater sage-grouse, such as red fox or skunks, can also serve as prey to larger predators such as coyotes.

Historically, predator control programs in North America were designed to protect domestic livestock, not wildlife (Hagen 2011). Predator control as a tool to manage grouse populations was rarely recommended historically, even for threatened and endangered populations in altered or fragmented habitats (Patterson 1952, Schroeder and Baydack 2001). It is likely the termination of widespread predator control in the early 1970s has influenced changes in predator abundance observed anecdotally by the public in recent years (Montana

Sage Grouse Working Group 2005). Maintaining and enhancing intact ecosystems of sufficient size and quality to support a particular species is of greater ecological value and sustainability than an alternate approach that relies heavily on human intervention (e.g., artificial feeding, predator control, animal husbandry, zoos). The former approach works with the natural system that is adapted to working as an interconnected resilient network. The latter approach is costly, temporary, risks variable results, and is not likely to avert an ESA listing (USDI 2010).

Human altered landscapes have contributed to significant increases over historical numbers in some predator abundances, particularly red fox and ravens (Coates and Delehanty 2010, Sauer et al. 2012). The influx of predators in altered sagebrush habitat can lead to decreased annual recruitment of greater sage-grouse (Schroeder and Baydack 2001, Coates 2007, Hagen 2011). Greater sage-grouse in altered systems are typically forced to nest in less suitable or marginal habitats where predators can more easily detect nesting birds (Connelly et al. 2004).

Habitat fragmentation, infrastructure, weather, urban development, and improper grazing can increase predation on greater sage-grouse. Greater sage-grouse populations demonstrate annual and cyclic fluctuations, which are influenced by weather patterns such as drought and the composition and abundance of predators (Montana Sage Grouse Working Group 2005). Montana greater sage-grouse populations appear to cycle over approximately a 10-year period under existing habitat conditions and the current combination of weather and predation (Montana Sage Grouse Working Group 2005; Montana Fish, Wildlife and Parks, unpubl. data). Longer term trends in greater sage-grouse population abundance and distribution can be a function of habitat loss or deterioration (Garton et al. 2011). The majority of Montana's greater sage-grouse populations are expected to persist over the next 100 years, if habitat conditions remain consistent, which suggests Montana's populations are relatively stable (Garton et al. 2011).

Greater sage-grouse are part of the sagebrush-grassland ecosystem that comprises an interlinked web of plant and animal species, including herbivores and carnivores. As one of many prey species in sagebrush habitats, greater sage-grouse are adapted to predation and in unaltered systems will persist indefinitely with predation pressure (Hagen 2011). The influence of predation on greater sage-grouse population dynamics only becomes a problem when vital rates, especially nest, chick, and hen survival, are consistently reduced below naturally occurring levels (Taylor et al. 2012). Naturally-occurring variability in vital rates is a function of annual variation in conditions (e.g., weather, vegetation cover quality, predator abundance) and is expected with a species that shows cyclic tendencies.

Based on a number of research projects, reported vital rates for greater sage-grouse populations in Montana vary within range-wide estimates, suggesting predation rates are within the range of normal variability. Good quality and quantity of habitat reduces predation pressure and is essential for greater sage-grouse population stability. Predator management can provide beneficial short-term relief to localized greater sage-grouse populations where predation has been identified as a limiting factor for population stability. Predator control is managed cooperatively by Animal and Plant Health Inspection Service (U.S. Department of Agriculture) Wildlife Service, MFWP, and the USFWS. Federal laws, such as the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act, limit options for managing avian predators.

Recent predator control programs designed to benefit greater sage-grouse have had mixed results (USDI 2010, Hagen 2011). In Strawberry Valley, Utah, fox removal appeared to increase adult survival and productivity but inference is limited because a control area was not included to compare changes in demographic rates, which were coincidentally increasing across the region during the study period (Baxter et al. 2007). Coyote control, however, appeared to have no effect on nest success or chick survival in Wyoming (Slater 2003). In fact, removal of coyotes can lead to a release of otherwise suppressed medium-sized predators, such as red fox, which tend to be more effective predators of greater sage-grouse nests and individuals (Mezquida et al. 2006).

Ongoing control efforts of mammalian and avian predators (except raptors) in southwestern Colorado designed to increase recruitment in a small population of Gunnison's greater sage-grouse may be showing some success but sample sizes are extremely low (5 chicks monitored/year; Colorado Parks and Wildlife, pers. comm.). There are 13 displaying males currently in this population and cost of monitoring and control has totaled $267,000

over 5 years (Colorado Parks and Wildlife, pers. comm.), bringing in to question the sustainability of this program.

LIMITING FACTORS FOR WILDLIFE

Although there are many limiting factors (factors that limit species distribution and abundance) specific to individual wildlife species, there are a variety of shared factors among most species. The principle factors that limit all wildlife distribution and populations include natural occurring impacts (e.g. fire, severe winter, summer drought) and human caused habitat fragmentation which results in habitat degradation.

Habitat Fragmentation

Wildlife habitat is a function of the interaction of physical (e.g., vegetation, climate, soils, geology, and elevation) and disturbance factors (e.g., anthropogenic, fire, grazing, etc.). Human actions have substantially changed the physical and disturbance factors through alteration of pattern, composition, structure, and function of plant and animal communities. In some instances, the disturbance factors have resulted in shifts in wildlife species presence and abundance.

The most pervasive and extensive change to the grassland ecosystems of North America is the conversion of native grasslands in the Great Plains to agriculture (Samson, Knopf, and Ostlie 2004). As a result of the Homestead Act, over 309,000 square miles of land was converted to crops, primarily in the Great Plains (Samson et al. 2004). The planning area has experienced less conversion than other areas of the Great Plains, with about 60 percent remaining in native vegetation (Samson et al. 2004).

Converting native grasslands to agricultural lands not only resulted in a direct loss of habitats for many native wildlife species, it began a process of habitat fragmentation. Habitat loss is exacerbated when fragmentation reduces habitat size; isolates remaining habitat patches below the size thresholds necessary to support components of biological diversity; or blocks the movement of animals between habitat patches. For example, one indirect impact of fragmentation for greater sage-grouse is a change in predator communities or disease dynamics (Naugle, Doherty, Walker, Holloran, and Copeland 2011).

Additionally, as large contiguous blocks of habitat are broken into smaller blocks, wildlife became more isolated from one another by dissimilar habitats and land uses. As this occurs, individual wildlife species and populations of wildlife species incur impacts, such as isolation. This is particularly evident for species which require intact landscape level habitats (e.g. grassland birds and Greater sage-grouse - Samson and Knopf 1994; Schroeder et al. 1999; Knick, Dobkin, Rotenberry, Schroeder, Vander Hagen, and van Riper III 2003; Crawford et al. 2004; Holloran and Anderson 2005b; Walker, Naugle, and Doherty 2007; Doherty 2008; Knick, Hanser, Preston 2013). While conversely, smaller birds like the Sprague's pipit can persist in landscapes with smaller patches of habitat because their spatial requirements are smaller (Davis 2004).

Other disturbances, including roads, railroads, trails, irrigation systems, mineral development, and ROWs, also dissect and ultimately fragment the planning area. All the direct fragmentation to wildlife habitat also results in indirect impacts, which results in otherwise structurally functional habitat not being occupied by certain wildlife species. For example, noise and direct disturbances can impact greater sage-grouse beyond the area of direct disturbance (Braun, Oedekoven, and Aldridge 2002, Holloran 2005, Doherty, Naugle, and Evans 2010, Lyon and Anderson 2003; Naugle, Doherty, Walker, Copeland, Holloran, and Tack 2011, Patricelli, 2010).

While human disturbances have altered the landscapes throughout time, natural disturbances have also influenced the shape and function of wildlife habitats. The two primary natural disturbances that historically influenced wildlife habitat within the planning area are wildland fires and herbivory by native wildlife species (e.g. bison herds (Malainey and Sherriff 1996)). Although fire and herbivory may have been a natural occurrence in the planning area and vegetation adapted with these influences, human interaction with the environment has altered both (see *Chapter 3 Fire, Livestock Grazing, Forestry, and Vegetation*).

The principle human influence from herbivory to wildlife habitats is the introduction of and the current use of the majority of the lands in the planning area for domestic livestock. Although domestic livestock herbivory does not preclude wildlife and functional habitats, they do influence ecological pathways and species persistence (Bock, Bock, and Smith 1993). Additionally, it is important to note that the effects of livestock herbivory on sagebrush habitats are much different from effects noted in the Great Basin since the landscape throughout Management Zone 1 is adapted to withstand grazing disturbance (Knick et al. 2011). Perhaps the most pervasive change to wildlife habitat associated with domestic livestock management is not the herbivory actions, but the construction of rangeland improvements (e.g. fencing and water developments (Knick et al. 2011).

In addition to historical herbivory influences, wildland fire often occurred and fire regimes were probably highly variable depending on rainfall and subsequent grass growth. These burns also removed much of the vegetation, which resulted in continual shifts in the abundance and distribution of wildlife species across large areas (Umbanhowar 1996). The federal policy to suppress all wildfires on federal lands, coupled with climate change, has increased wildland fire severity in some wildlife habitat types (See *Air, Fire, or Forestry* sections in Chapter 3). Drought and native species conversion also contribute to intensity as well. The natural role of wildfire in the ecosystem would have maintained the natural range of variability of vegetation and thus maintained fire intensity to within the parameters of the fire regime for that area.

The interactions between historical fire suppression effects and climatic factors in certain wildlife habitat types (e.g. ponderosa pine) can increase wildland fire size and therefore result in habitat fragmentation beyond what is believed to occur historically. For example, recent wildland fire has resulted in the fragmentation of approximately 90,000 acres or 22% of the big game crucial winter range in Powder River County. In addition, wildland fire impacts in big sagebrush wildlife habitat type does result in the mortality of big sagebrush in the planning area (MNHP 2012). However, the terrain associated with the big sagebrush habitat type, in combination with the fuel composition, does not typically result in large scale fires in this habitat within the planning area.

Wildlife habitat fragmentation does have the potential to benefit some species of wildlife. For example, Raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), and red fox (*Vulpes vulpes*) have benefited from habitat fragmentation and are more common now than in the past. Wildlife habitat fragmentation has the potential to cause the greatest impacts to wildlife populations and wildlife habitat (Hebblewhite and Merrill 2008). The magnitude of the impact depend, at least in part, on the timing, duration and nature of the disturbance, winter conditions, species and habitat types present, physiological status of the individual, and other disturbance factors.

WILDLAND FIRE MANAGEMENT AND ECOLOGY

Fire occurrence in the planning area is presented in several subsections detailing fire history, current fire policy, wildland fire suppression, fire regimes, and current fire management.

FIRE HISTORY

Between 1991 and 2011, the BLM responded to 2,012 fires that burned 908,053 acres across the planning area. The BLM responds to wildfires on USFS, USFWS, and BLM-administered lands and assists on Tribal, state, and local agency wildfire suppression actions within the Eastern Montana Fire Zone. The Eastern Montana Fire Zone exhibits a very active fire season, with an average annual fire occurrence of 96 fires. Wildfire size and duration are affected by terrain, weather conditions, and fuel type. Although similar fuel type and terrain occur throughout the planning area, higher frequencies of fires occur in areas with timber and higher elevation. The major cause of fires is lightning and multiple fire start days are common during the months of July through September. Generally, the season starts in June and continues through September with the majority of the fires occurring during July and August (Table 3-24 and Map 23).

TABLE 3-24.
FIRE HISTORY BY FIRE SIZE CLASS IN THE EASTERN MONTANA ZONE (1991 TO 2011)

Fire Management Unit	Fire Class							Total Number of Fires	Total Acres
	A	B	C	D	E	F	G		
Cedar Breaks	1	3	2	0	0	0	0	**6**	**141**
Mixed Grass Prairie Sagebrush	32	197	165	47	57	27	11	**536**	**359,017**
Rural Interface	16	25	5	1	3	1	0	**51**	**2,858**
Vicinity of Custer National Forest	72	216	54	11	8	12	6	**379**	**179,543**
Knowlton-Locate	1	5	1	2	0	0	0	**9**	**1,291**
Missouri-Musselshell River Breaks	16	57	35	10	5	4	2	**129**	**148,398**
Ashland Ranger District	191	466	64	8	10	5	8	**752**	**215,873**
Sioux Ranger District	45	90	13	2	0	0	0	**150**	**933**
Total	**374**	**1,059**	**339**	**81**	**83**	**49**	**27**	**2,012**	**908,054**

Fire Class Sizes: A (less than 0.2 acres), B (0.3 to 9 acres), C (10 to 99 acres), D (100 to 299 acres), E (300 to 999 acres), F (1,000 to 4,999 acres), and G (more than 5,000 acres).

CURRENT FIRE POLICY

Until the 1960s, federal fire policy emphasized control of all wildfires by 10:00 a.m. the following day. Prompted by passage of the Wilderness Act of 1964 (16 U.S.C. 1131 et seq.), fire managers began to consider the natural role of fire in the environment. This changed the strategy from fire control to one of fire management. Options available under this new fire management strategy allowed for fire by prescription and a range of suppression alternatives to achieve fire management objectives. The 2009 *Guidance for the Implementation of Federal Wildland Fire Management Policy* (USFS, BLM, BIA, USFWS, and NPS 2009) provides revised direction for consistent implementation of the *Review and Update of the 1995 Federal Wildland Fire Management Policy* (USDI et al. 2001). The current guidance allows fire managers to use various wildland fire management responses for all wildland fires. These responses vary from aggressive initial attack with the intent of minimizing the number of acres burned to monitoring fires in an effort to reduce suppression costs, provide resource benefits, and reduce firefighter exposure to the hazards of fire suppression.

The Big Dry and Powder River RMPs, the *Montana State Office Fire/Fuels Management Plan Environmental Assessment/Plan Amendment for Montana and the Dakotas*, and the MCFO *Fire Management Plan* currently guide wildland fire management in the planning area (BLM 1985c, 1996, 2003k, and 2004f).

The *Montana State Office Fire/Fuels Management Plan Environmental Assessment/Plan Amendment for Montana and the Dakotas* (BLM 2003k) amended the Big Dry and Powder River RMPs to update direction for fire and fuels management. These amendments provided:

- consistent fire management direction by assigning fire management categories and broad levels of treatment;
- general guidance for fire management needed to protect other resource values; and
- revisions to RMP decisions that limited the BLM's ability to conduct safe and efficient mechanical hazardous fuels treatments.

WILDLAND FIRE SUPPRESSION

Previous land use planning handbook guidance required RMPs to categorize lands in fire management zones into fire management categories (A through D). Under current management, the MCFO lists seven fire management zones, categorized as B or C. Current fire management planning and land use planning guidance does not require fire management categories and recommends the use of fire management units definable by similar vegetation type and condition, predominant historical fire regime groups, and management constraints,

objectives, and strategies. Fire management units are a dynamic boundary designed to be redrawn as resource uses within those areas change and resource management considerations change. For each fire management unit, management recommendations are developed for the following fire management activities: wildland fire suppression, management of wildland fire to meet multiple objectives, prescribed fire and non-fire fuel treatment, emergency stabilization, rehabilitation, and community assistance or protection.

General management considerations are:

- to use sound scientific resource management principles to restore or sustain ecosystem health (balanced with other socioeconomic goals including public health and safety) and air quality;
- to identify and provide wildland fire response on all wildland fires consistent with resource objectives, standards, and guidelines;
- to use prescribed fire, mechanical, chemical, and biological treatments to meet management goals and objectives;
- to work collaboratively with communities at risk to develop plans for risk reduction; and
- to work collaboratively with federal, state, and local partners to develop cross-boundary management strategies and prioritize cross-agency fire management actions.

Following direction from the Healthy Forests Restoration Act in 2003 (16 U.S.C. 6501 et seq.), the MCFO partnered in developing community wildfire protection plans. This legislation includes statutory incentives for BLM to consider the priorities of local communities as they develop and implement forest management and hazardous fuel reduction projects. These plans are dynamic and regularly updated by each county. The BLM works with counties to identify high-risk areas and work cooperatively to mitigate fire risk to identified communities. All but three counties in the planning area have completed community wildlife protection plans. Currently, all communities within the planning area are rated moderate to high for risk of property loss from wildland fire.

Fire management includes management responses that range from a full suppression response to minimal impact tactics and utilization of wildfire to achieve ecological benefits. The type of management response or the combination of various methods is dependent on the goals and objectives within the fire management unit. Advancement in suppression equipment technology has improved the effectiveness and efficiency of many types of fire suppression apparatus and associated suppression products available to fire managers. In addition to use of water, foams, gels and retardants are currently available to fire managers within the federal agencies. Method of application of these products also varies from standard engine apparatus to use of Large Air tanker aircraft. Aerial delivery of fire retardant has been in use for over 60 years in the federal fire suppression agencies on public lands. More recently, aerial delivery of foam and gel has been utilized in areas of the county. Aerial delivery of suppression chemicals has proven to be a safe efficient and effective in controlling wildfires that otherwise would be uncontrollable by ground methods. Through research and development, changes in chemical components of fire retardant have resulted in products available to the federal fire agencies that are safer to the environment and more effective in wildfire suppression. In 2011, the federal fire agencies aerially delivered 23,495,040 gallons of fire retardant on wildfires throughout the United States. Over the past 12 years of data collected, there was a total of 1,421,405 gallons of retardant delivered on wildfires throughout the planning area. In a recent (the Record of Decision [ROD] was signed in 2011) EIS completed by the USFS, in which the BLM was a cooperating agency, the analysis recognized four main issues related to fire retardant use on USFS lands and its effects. Health and human safety, water quality, impacts on threatened and endangered species, and impacts on cultural resources were the four main issues for which the EIS analysis focused. Within the planning area, effects from suppression foams, gels, and retardant to these same four issues are analyzed.

FIRE REGIMES

According to coarse-scale estimates, fire regimes have been altered on BLM-administered lands; the result is evident in the increasing changes of fire size, intensity, and landscape pattern. Fire regimes on BLM-administered lands are characterized by three potential natural vegetation groups (PNVGs) described by the Landscape Fire and Resource Management Planning Tools Project (LANDFIRE), a joint USFS and USDI program, as vegetation communities existing under the natural range of variability in biophysical environments

and ecological processes (2007):

- Plains Grassland, 54%;
- Shrubland, 28%; and
- Tree, 18%.

This biophysical classification was based originally on A.W. Kuchler's 1964 *Potential Natural Vegetation of the Conterminous United States* (American Geographic Society Special Publication No. 36) and modified during the *Coarse-Scale Fire Regime Condition Class Assessment* (Schmidt, Menakis, Hardy, Hann, and Bunnell 2002). Fire regime and condition classes (FR/CC) (Hann et al. 2008) reflect the degree of departure from modeled reference conditions. FR/CC assessments measure departure in two main components of ecosystems: fire regime (fire frequency and severity) and associated vegetation. Implementation of all fire management activities are based on project-specific surveys.

The Plains Grassland PNVG is found scattered throughout the decision planning area, occurring on rolling uplands and flats where naturally frequent fires excluded shrubs and maintained grass dominance. The historical fire return interval in this PNVG was about 8 to 12 years. Fires are more frequent in productive closed grass types, and flashy light fuel types cause moderate to high rates of spread in these areas. However, development, grazing, and elimination of fire as an ecological process have resulted in a moderate departure from this fire regime (USFS and USDI 2007). Several communities in the planning area within or near this PNVG are at moderate risk from wildfire.

The Shrubland PNVG is found throughout the planning area. The historical fire return interval in this PNVG has a mixed fire regime with a 15- to 20-year frequency. Removal of fire as an ecological process, conifer encroachment, development, and grazing have resulted in a moderate departure from this fire regime. Flashy light fuel types in cause moderate to high rates of spread in these areas. Fires starting during times of critical or high fire danger continue when frequent high winds rapidly change small fires into large fires (USFS and USDI 2007). Most communities located within or near this PNVG are at moderate risk from wildfire.

The Ponderosa Pine PNVG is found scattered throughout the planning area, occurring mostly within the Missouri Breaks in Garfield County, areas south of the Yellowstone River, Ekalaka Hills-Chalk Buttes in Carter County, Cedar Creek Anticline, and Terry Badlands. The historical fire return interval in this PNVG is approximately 25 years, but uncharacteristic succession and numerous missed fire-return intervals have caused a high departure from this fire regime (USFS and USDI 2007). In the Missouri Breaks, large fires exceeding 1,000 acres have occurred every 3 years on an average. Wind, low fuel moistures, and ladder fuels increase the likelihood of extreme fire behavior. Forest stand densities are high, and these areas are at risk for large stand-replacing fires. There are several communities at high risk from wildfire within or near this PNVG.

Climatic Change and Fire Regime and Wildfire

Evidence of wildfire can be traced through the review of fire scars across all landscapes in the Northern Rockies. Research conducted in forested sub-regions in the Northern Rockies suggests climatic change has had an effect on fire regimes. Historical wildfire observations exhibit an abrupt transition in the mid-1980s from a regime of infrequent large wildfires of short (average of 1 week) duration to one with much more frequent and longer-burning (5 weeks) fires. This transition was marked by a shift toward unusually warm springs, longer summer dry seasons, drier vegetation (which provoked more and longer-burning large wildfires), and longer fire seasons (Westerling et al. 2006b).

The Cost of Wildfire Management

The MCFO planning area is an intermix of BLM-administered lands among private, state, and other federal agency jurisdictions. Wildfire occurs on all lands and all jurisdictions and wildfire suppression efforts often involve all jurisdictional agencies. The cost of wildfire goes beyond suppression activities. Suppression costs are dependent on many factors; including, but not limited to, location of the fire, fuel type, weather conditions, duration of the event, the quantity and type of suppression resources used, actions to rehabilitate suppression activity damage to lands and infrastructure, and subsequent emergency stabilization and rehabilitation actions. Other costs or "losses" include timber and forage values, wildlife habitat and populations (including endangered

species and their critically protected habitat), air and water quality, recreational opportunities, local economies, and other resources and amenities important to all citizens. These costs are difficult to calculate and are often shared among many protecting agencies, therefore not definitive to any given protecting agency.

Nationally, the cost of wildfire management, specifically suppression has dramatically increased. "Suppression costs only represent a small portion of over-all wildfire costs and losses, however, and other direct costs, indirect losses, and post fire costs and losses can total 10 to 50 times (or more) the suppression costs." (Zybach, Dubrasich, Brenner, and Marker 2009, p. 14.) Longer periods of dryness and drought caused by global climate change provides more fuel to burn and results in longer wildfire seasons, which (along with population growth and urban sprawl into the wildland-urban interface) contribute to increased wildfire suppression costs.

A source of wildfire that has become more common or perhaps now more aware of as a cause, are coal seam outcrops. Coal seams outcrops are typically ignited as a wildfire passes over the exposed coal seam and ignites the mineral, which tends to burn slow and unnoticed in the subsurface. Within the planning area, some known actively burning coal seams are thought to have been ignited hundreds of years ago, only being noticed when the seam is exposed and comes in contact with dry vegetation at the surface and causes a wildfire.

CULTURAL RESOURCES

The BLM is responsible for identifying, protecting, managing, and enhancing cultural resources located on BLM-administered lands or nonfederal lands that may be affected by BLM management actions. Cultural resources include archeological, historic, architectural properties, and traditional lifeway values important to American Indian groups. Sites can vary with regard to their intrinsic value and their significance to scientific study; therefore, management practices employed are commensurate with their designation.

Cultural resources are any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious, or other purposes. Cultural resources include archeological resources, historic architectural and engineering resources, and traditional resources. Archeological resources are areas in which prehistoric or historic activity measurably altered the earth or in which deposits of physical remains (e.g., projectile points, pottery, or bottles) are discovered. Architectural and engineering resources include standing buildings, districts, bridges, dams, and other structures of historic or aesthetic value. Traditional resources can include archeological resources, structures, topographic features, habitats, plants, wildlife, and minerals that American Indians or other groups consider essential for the preservation of traditional culture.

Prehistoric and historic cultural resources are a nonrenewable resource. Significant cultural resources have many values, including use in gathering scientific information on human culture and history, interpretive and educational values, values associated with important people and events of significance in history, and aesthetic value (such as a prehistoric rock art panel or an historic landscape). Cultural resource sites may also have traditional cultural values that are important to American Indian Tribes for maintaining their culture and cultural identity.

According to BLM Manual 8110, the primary objectives of the cultural resources program are to manage BLM-administered cultural resources through a system of identification, evaluation, interpretation, utilization, and reduction of conflict between cultural resources and other resources and resource uses. Cultural resource management objectives would include developing site or area-specific activity plans to identify cultural resource use and protection objectives and outline procedures for evaluating accomplishments.

CURRENT RESOURCE MANAGEMENT AND THE BLM'S RESPONSIBILITIES, POLICIES, ACTS, AND PROTOCOLS RELATED TO THE MANAGEMENT OF CULTURAL RESOURCES

The BLM is legally mandated to identify, evaluate, and manage cultural resources under federal laws and executive orders, most prominently the Antiquities Act of 1906, National Historic Preservation Act (NHPA) of 1966, NEPA of 1969, the Federal Land Policy and Management Act (FLPMA) of 1976, as amended, and

Executive Order 11593 (May 13, 1971). BLM manuals 8100, 8110, 8120, 8130, 8140 and 8150 and Handbook H-8120, outline BLM policy and cultural resource program guidance. Apart from certain considerations derived from specific cultural resource statutes, management of cultural resources on public lands is primarily based on FLPMA and fully subject to the same multiple use principles and planning and decision-making processes followed in managing other public land resources.

In 1997, the BLM developed an agreement addressing means of complying with NHPA. This agreement was updated in 2012 (*Programmatic Agreement among the Bureau of Land Management, the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers regarding the Manner in which BLM will meet its Responsibilities under the National Historic Preservation Act)*. Pursuant to the 1997 agreement, the BLM Montana State Office developed a specific process by which NHPA compliance is accomplished, (1998 *State Protocol Agreement between the Montana State Director, Bureau of Land Management and the Montana State Historic Preservation Office regarding the manner in which the BLM will meet its responsibilities under the National Historic Preservation Act as provided for in the National Programmatic Agreement).*

- The BLM is responsible for ensuring that lands leased for development (such as oil, gas, or coal development) are examined prior to allowing any development actions to occur to determine the presence of cultural resources and to specify mitigation measures. For oil and gas development, the BLM employs a phased approach to site identification and completes site identification surveys at the application for permit to drill (APD) stage. Guidance for application of this requirement for oil and gas development can be found in the notice to lease, MSO-1-85, Washington Office (WO) IM 2005-03, and Montana IMs 2003-035 and 2006-040 (BLM 1985b). The agency would conduct Class I, II, or III cultural inventories for lands that included surface disturbances as part of the action. Class III inventories are usually required before surface-disturbing actions are authorized by BLM (and before land disposal actions).

- Cultural resource awareness programs, including educational programs, presentations, and interpretive displays, would be designed to enhance the public appreciation of cultural resource values, and the BLM would make significant cultural sites available for scientific study.

- The BLM would accommodate access to public lands by American Indians to enable tribes to maintain traditional values intrinsic to their cultural identities in accordance with Executive Order 13007 (May 29, 1996). The BLM would also conduct consultations with American Indian Tribes as sovereign nations in a government-to-government relationship. Prior to site-specific project approval, BLM would consult with affected tribes to identify cultural values or religious beliefs that might be affected by BLM proposed actions.

HISTORY OF CULTURAL RESOURCE INVESTIGATIONS IN THE PLANNING AREA

Site identification and recording in the planning area dates to the mid-20th century, when the Montana Archeological Survey and the Works Project Administration conducted excavations on several sites in southeastern Montana in the 1930s (including the Hagen National Historic Landmark [NHL] [24DW0002]).

Limited archaeological work occurred in the planning area between the end of WWII and the 1970s. Most of the work focused on proposed Federal reservoirs or excavations undertaken by avocational archaeological groups such as the Sheridan Chapter of the Wyoming Archaeological Society's excavation at the Powers-Yonkee Site (24PR5) in the early 1960s (Bentzen 1962). Since the early 1970s, there have been extensive modern cultural resources investigations in the planning area. Most investigations have been accomplished in compliance with Section 106 of the NHPA and provisions of NEPA, both of which require federal agencies to consider the potential effects of federally assisted or permitted projects on important cultural resources. The BLM has performed cultural resources investigations in the planning area pursuant to the BLM stewardship responsibilities under NHPA Section 110, which requires federal land management agencies to identify and preserve important cultural resources on lands administered by those agencies.

PREHISTORIC, PROTOHISTORIC, AND HISTORIC PERIODs

A generalized prehistory of eastern Montana can be categorized in a chronological framework in which periods are distinguished based on differences in material culture traits or artifacts and subsistence patterns. These periods include the Paleo-Indian (ca. 12,500 years before present [BP] to 7800 BP), Archaic (ca. 7800 BP to 1500 BP), Late Prehistoric (ca. 1500 BP to 200 BP), Protohistoric (ca. 250 BP to 100 BP), and Historic Periods, For information on and a more in-depth discussion of the planning area's cultural chronology refer to the Class I Overview (Aaberg et al. 2006) on the BLM's Miles City RMP Website.

The prehistoric period begins with man's entry into the Planning area some 11,000-12,000 years ago and continues to the presence of non-native trade goods and animals. The Protohistoric Period in southeastern Montana is generally defined as the period in which the horse and European trade goods reached native cultures. Introduction of the horse in the Northern Plains area probably occurred sometime between A.D. 1700 and A.D. 1750 but appears to have occurred earlier in localities just south of Montana and later in more northern localities. The earliest European to venture into the planning area was likely the Frenchman Sieur de la Verendrye in 1742, followed by Francois Larocque of the Canadian-owned North West Company, passing through the area in 1805. However, substantial contact and white settlement of the area did not occur until after Lewis and Clark visited the area in 1805 and 1806 (Aaberg et al. 2006), which ushered in the Historic Period, and not until fur-trading posts were established on the Yellowstone and upper Missouri rivers in the early 1800s, which were the first permanent European settlements in the region.

RESOURCES IN THE PLANNING AREA

Cultural Resource Identification

In general, cultural resources are identified through field inventories conducted by qualified professionals in order to comply with Section 106 of NHPA. Informant information and historical records are also used to identify archeological, historical, and traditional lifeway values and traditional cultural properties (TCPs). Three types of inventories (Class I, Class II, and Class III) are conducted to identify and assess these values on BLM-administered lands.

A Class I inventory is a professionally prepared study that includes a compilation and analysis of all reasonably available cultural resource data and literature and a management-focused, interpretive, narrative overview and synthesis of the data. The overview also defines regional research questions and treatment options. The MCFO has prepared or funded three Class I Overviews. The first two focused on prehistoric resources as data accumulated from cultural resource management studies in the 1970s and 1980s (Clark 1979, Deaver and Deaver 1988). The third overview was prepared in support of this RMP and incorporates both historic and prehistoric information (Aaberg et al. 2006).

A Class II probabilistic field survey is a statistically based sample survey designed to aid in characterizing the probable density, diversity, and distribution of cultural properties in an area, to develop and test predictive models, and to answer certain kinds of research questions. BLM has conducted or sponsored several Class II Inventories. These generally were done in the Late 1970s and early 1980s when little was known about the nature and distribution of cultural resources in the planning area. Most of the Class II surveys would not meet current survey standards.

Class III, intensive field survey: an intensive survey is most useful when it is necessary to know precisely what historic properties exist in a given area or when information sufficient for later evaluation and treatment decisions is needed on individual historic properties. Most surveys for land disturbing activities conducted today would be considered Class III inventories. Examples of Class III inventories would be inventories conducted for oil or gas well pads and infrastructure, range improvement projects, and coal mine expansions.

Number of Cultural Resource Sites Recorded in the Planning Area

Cultural resource investigations in the planning area have recorded approximately 9,934 prehistoric and historic cultural resources. A 2006 Class I overview of cultural resources was prepared for the planning area. As of May 1, 2005, the planning area contained 7,065 prehistoric sites and 2,869 historic sites (Aaberg, et al 2006). Historic and prehistoric sites occur in all counties within the planning area and represent a wide variety of site types and chronological periods; together, these resources document an almost continuous record of human occupation for the past 12,000 years.

Based on studies conducted in the planning area (Aaberg et al. 2006), there is an estimated average density estimate of one cultural site for every 100 acres of land (BLM-administered and private surface) .Of these, approximately 10 to 15 percent of cultural resources are found eligible for the National Register of Historic Places (NRHP). Furthermore, there is an average of one research excavation every 5 years, which disturbs 1 to 5 acres. About 3.6 percent of the surface area in the planning area has undergone surface surveys of varying intensity. Of the 2,135 prehistoric and historic sites located on BLM-administered surface within the planning area, distribution and site density estimates is approximately 1 site per 195 acres (5.1 sites per 1,000 acres).

Of the total cultural properties in the project area, 2,135 (28.5 percent) occur either entirely or partially on BLM-administered land (Aaberg et al. 2006). The BLM site total includes 1,839 (86.1 percent) prehistoric sites and 296 (13.9 percent) historic sites; subsequently, 26 percent of all project area prehistoric sites and 10.3 percent of all project area historic sites in the planning area are either entirely or partially administered by the BLM.

Distribution of the 4,835 prehistoric and historic sites fully or partially located on lands of mixed ownership and administration is 1 site per 45.5 acres (22 sites per 1,000 acres) or 14.1 sites per square mile for the 220,187 acres of surveys conducted in this category. These sites include 2,756 prehistoric sites at 1 site per 79.9 acres (12.5 sites per 1,000 acres) or 8 sites per square mile. Also included are 2,079 historic properties at 1 site per 105.9 acres (9.4 sites per 1,000 acres) or 6 sites per square mile.

Of the 9,934 cultural sites, only 66 have been formally nominated to the NRHP. Of those sites listed, almost all are exclusively historic with only two prehistoric sites listed (the Hagen Site [24DW0002] in Dawson County and the Tipi Hills Site [24SH1008] in Sheridan County). Notable among these, the Hagen site, has been designated an NHL. Other notable prehistoric sites that have been determined eligible for listing in the NRHP that require additional or special management attention include the Long Medicine Wheel (a proposed Area of Critical Environmental Concern [ACEC] [24MC0148]), Belle Creek (24PR0881), and Chalk Buttes (24CT0309) medicine wheels; the Big Sheep Mountain (24PE0210), Hoe (24PE0263), Jordan Bison Kill (24GF0271), and Seline site (24DW0250) ACECs; and the Yonkee (24PR0005) and Mill Iron (24CT0030) sites and proposed ACECs.

Most of the remaining 64 historic-era resources that have been formally nominated to the NRHP are within town limits and are of limited interest because none of these are located on BLM-administered surface or include BLM-administered federal minerals. However, other notable historic-era resources designated NHLs include the Sioux-War-era Rosebud (24BH2461) and Wolf Mountain (24RB0787) (Battle Butte ACEC) Battlefields NHLs and the Fur-Trade-era Fort Union NHL (24RV0050). Other historic sites that have been determined eligible for listing in the NRHP that require additional or special management attention include the Sioux-War-era Reynolds (24PR0089) and Cedar Creek Battlefields (24PE0261) (proposed ACECs), Ash Creek Battlefield (24PE0629), Powder River Depot (24PE0231), Deer Medicine Rocks (24RB0401), Bark Creek (no site number) and Spring Creek (no site number) fight sites, and O'Fallon Creek Battle site (24PE0734) of 1872. In addition to the cultural resources listed on the NRHP, 421 historic properties have been formally determined to be eligible for nomination to the NRHP. Of the 7,065 prehistoric sites in the planning area, about 4 percent of prehistoric sites have been recommended as eligible (consensus varies) for listing in the NRHP and about 283 prehistoric sites have been formally determined to be not eligible for nomination to the NRHP. Of the 2,869 historic sites recorded within the planning area, about 4.8 percent of historic sites have been recommended as eligible for listing in the NRHP and about 138 historic sites have been formally determined to be not eligible for nomination to the NRHP. Significance or NRHP status of about 90 percent of prehistoric sites has either not been resolved or is not presented on the state database.

Of the approximately 9,934 recorded cultural resources in the planning area, only about 707 recorded prehistoric properties (or about 10 percent) and about 534 historic properties (or about 18.6 percent) have been evaluated for eligibility for nomination to the NRHP. These evaluations include sites that have been listed on the NRHP and sites for which the Montana State Historic Preservation Office has concurred with the evaluation. Concurrence by the state historic preservation office on NRHP evaluations is desirable, and while concurrence is not a foregone conclusion, in most cases the state historic preservation office will usually concur with agency determinations of eligibility. Eligibility for nomination to the NRHP is a major threshold for management consideration of sites.

Although state database and agency records are sometimes conflicting, it appears that about 5 percent of historic sites have been recommended (consensus varies) as eligible for listing in the NRHP and about 12 percent have been recommended and accepted as ineligible by the state historic preservation office. Significance or NRHP status for about 81 percent of historic sites is either unresolved or not presented on the state database. About 4 percent of prehistoric sites have been recommended as eligible (consensus varies) for listing in the NRHP while 6 percent have been recommended and accepted as ineligible.

Types of Cultural Resources Recorded in the Planning Area

Most recorded prehistoric sites in the planning area consist of lithic scatters, campsites or habitations of various kinds, stone circles, and stone cairns. Other prehistoric site types include burials, ceremonial stone circles and rock alignments, rock art, rock shelters, ceramic sites, quarries and secondary lithic procurement sites, structures, and bison kill and butchering sites. Recorded historic cultural resources in the planning area include trails; freight wagon, stagecoach, and military trails; Indian-War-period battle sites; early ranches and farms; stockherding camps; irrigation systems; mines; early oil fields and associated camps; railroads, bridges; and urban buildings.

National Historic Landmarks, Landscapes, and Archeological Districts in the Planning Area

There are a number of areas designated NHLs, archeological landscape districts, or archeological districts of particular interest to this RMP, including the:

- Spring Creek Archeological District (24BH3584) (Big Horn County),
- Battle of the Rosebud NHL (24BH2461) (Big Horn County),
- Wolf Mountains Battlefield NHL (24RB0787) (Rosebud County),
- Lee Community Historic District (24RB2053) (Rosebud County),
- Castle Rock Community Historic District (24RB2090 and 24TE0119) (Rosebud County),
- Deer Medicine Rocks NHL (24RB0401) (Rosebud County), and
- Fort Union Trading Post NHL (24RV0050) (Roosevelt County)

Sites of Specific Concern within the Planning Area

Some sites and site types of special concern and that need special management have been designated ACECs in past planning efforts. Other sites and site types are sensitive to their setting and require special consideration and management to protect their setting and surrounding landscapes, such as sites of interest to American Indians.

A number of other sites have moderately sensitive settings and require some management protections from changes to their immediate surroundings. Most of these sites are bison kill or processing sites and include the Seline (24DW0250), Jordan Bison Kill (24GF0271), and Mill Iron (24CT0030) sites. Each of these sites have either been designated ACECs or are proposed ACECs in this RMP. Also included in this category is the Hoe ACEC (24PE0263) site, a site containing evidence of past horticultural practices and the Big Sheep Mountain (24PE0210) ACEC, a Late Middle Period-Pelican Lake phase habitation site with buried hearths.
The planning area also contains many sites with very sensitive settings that require a greater degree of protection from management actions with the potential to alter the surrounding setting. Included in this category are:

- Indian-War-era sites and battle sites, which include the areas described below.

    - Ash Creek Battlefield (24PE0629): this area was the site of an 1876 Sioux War battle between Sitting Bull and the United States Army (Lieutenant Baldwin under Colonel Miles) along Ash Creek, a tributary of the Redwater River south of Brockway, Montana.
    - Rosebud Battlefield NHL (24BH2461): this site, which is designated an NHL, represents one of the major engagements of the Sioux War of 1876. The battle, between the Sioux and Cheyenne and the United States Army (General Crook), occurred along Rosebud Creek north of Decker, Montana.
    - Bark Creek fight site (no site number): this was the site of a brief battle along the Missouri River a short distance east of Fort Peck near what is believed to be either the mouth of Lost Creek or Hungry Creek between the United States Army (Lieutenant Baldwin under Colonel Miles) and Sitting Bull and his followers.
    - Spring Creek fight site (no site number): this area was the site of a series of skirmishes in which bands of Sioux warriors attacked a supply wagon train bound for the Tongue River Cantonment between Glendive and Fallon, Montana, during the 1876 Sioux War.
    - O'Fallon Creek Battle (24PE0734): site of an 1872 Indian War battle between Sitting Bull and the Lakota Sioux and the United States Army (under Colonel Stanley) while the latter members were guarding railroad surveyors near the mouth of O'Fallon Creek.
    - Reynolds Battlefield ACEC (24PR0089): portions of this battlefield are already designated an ACEC and the remaining area is proposed for ACEC designation. This is the site of the opening battle of the Sioux War of 1876 between the United States Army (Colonel Reynolds under General Crook's command) and the Cheyenne occurred along the Powder River.
    - Battle Butte ACEC (24RB0787): portions of this battlefield, which includes the Wolf Mountain NHL, are already designated an ACEC and the remaining area is proposed for ACEC designation. This site of an 1877 Sioux War battle between Colonel Miles and Crazy Horse and the Oglala Lakota is situated along the Tongue River.
    - Powder River Depot ACEC (24PE0231): this area has been designated an ACEC. This site, which is located on the Yellowstone River near the mouth of the Powder River, was a major campsite and supply depot for the United States Army under General Terry and Colonel Custer during the Sioux War of 1876.
    - Cedar Creek Battlefield (24PE0261): this site, which is proposed for ACEC designation, was the site of a battle between Sitting Bull and the Lakota Sioux and the United States Army (under Colonel Miles) in the hills along the upper reaches of Cedar Creek north of Terry, Montana.

- Historic trails and Fur-Trade-era sites, which include the Lewis and Clark Trail and Fort Union NHL.

    - Lewis and Clark Trail: this area is a corridor that encompasses portions of the Missouri and Yellowstone Rivers and commemorates the Lewis and Clark expedition from 1805 to 1806.
    - Fort Union NHL (24RV0050): this site represents one of the major Fur Trade era trading posts on the upper Missouri River. Established in 1828 by John Jacob Astor's American Fur Company, it became the headquarters for trading beaver pelts and buffalo hides with tribes of the upper Missouri and Yellowstone River regions.

- Prehistoric village sites, which include the Hagen site NHL (24DW0002), which is a village occupation site on the banks of the Yellowstone River once occupied by Middle Missouri horticulturists, such as the Mandan.

- Sites and landscapes of American Indian interest include the areas described below.

    - Long Medicine Wheel (24MC0148): this site, which includes a large stone ceremonial circle, is proposed for ACEC designation and is a very rare site type of religious significance to American Indian Tribes.
    - Deer Medicine Rocks (24RB0401): a petroglyph site of great religious significance to American Indian Tribes, particularly the Sioux, in which Sitting Bull's vision of soldiers

falling into camp is depicted. This site is used for traditional cultural purposes.

- Belle Creek Medicine Wheel (24PR0881): this site, which consists of a large stone circle with spokes, is another example of a very rare site type (like Long Medicine Wheel) of religious significance to American Indian Tribes.
- Chalk Buttes Medicine Wheel (24CT0309): this site, which is a large stone circle with interior divisions, is within the USFS-administered unit of the Chalk Buttes and yet another example of a very rare site type of religious significance to American Indian Tribes. This site is used for traditional cultural purposes.
- Chalk Buttes: is a site that includes an upland mountainous chain of buttes with religious significance to American Indian Tribes. Sitting Bull and Crazy Horse wintered in this area prior to the Sioux War of 1876, and the area is still in use for traditional cultural purposes by American Indian Tribes. This area has been determined a TCP and is recommended for eligibility to the NRHP, and the entire area is used for traditional cultural purposes.
- Medicine Rocks State Park: this area has also been determined a TCP and is recommended for eligibility to the NRHP. In addition, the entire area is used for traditional cultural purposes.
- Tongue River Valley Cultural Landscape: this area extends from the Tongue River Dam in the south to Ashland, Montana, in the north and is both a Cultural Rural Historic Landscape and an Ethnographic Landscape for the Cheyenne.

Use Categories

To focus management on the variety of identified cultural resources, sites would be assigned to cultural resource use categories as defined in the BLM Manual 8110 Categorizing cultural resources according to their potential uses is the culmination of the identification process and the bridge to protection and utilization decisions. Use categories establish what needs to be protected, and when or how use should be authorized. All cultural resources have uses, but not all should be used in the same way. Classes of cultural resources can be allocated to the various recognized use categories even before they are individually identified. The advantage in doing this is that it allows field office managers to know in advance how to respond to conflicts that arise between specific cultural resources and other land uses. Relative to the 2012 national *Programmatic Agreement among the Bureau of Land Management, the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers regarding the Manner in which BLM will meet its Responsibilities under the National Historic Preservation Act*, categorizing resources to uses provides a mechanism for the field office manager and the state historic preservation officer to confer and concur on how to handle most routine cases of conflict in advance, which enables the field office manager to put decisions into effect in the most appropriate and most timely manner.

In order to allocate the numerous known sites and those sites projected to occur (sites yet to be found or recorded) into the identified use categories, criteria must be established that employ a combination of easily recognizable site-type and site-attribute information that can, for example, differentiate between small, short duration, limited-activity sites and large, complex, multiple-activity sites. For prehistoric resources, the criteria are weighted to emphasize the information potential since the determination of significance for such sites are generally related to their scientific value. For historic resources, the criteria are more reflective of site condition and integrity characteristics, which play a greater role in the evaluation of historic properties.

It is also important to recognize that it is possible for sites to be placed into more than one use category; a prehistoric site with little or no scientific value could be placed in a discharged from management category, but could also be appropriate in the experimental use category. Similarly, a historic site could be placed in the public use category, but require stabilization and preservation efforts and therefore warrant placement into the conserve for future use category as well.

The term designated area or site used in the Chapter 2 table, *2-1 Comparison of Alternatives*, refers to sites or areas that are currently designated or that meet the criteria for allocation for designation for one of the use categories; scientific use, conservation use, traditional use (socio-cultural use), public use, and experimental use. It also includes the boundaries of sites or districts eligible for, or included on, the NRHP as well as boundaries of TCPs or designated sites or areas, or sites or areas that meet the criteria for allocation for

designation for traditional use (for cultural properties determined to be of particular importance to American Indian groups).
TCPs include cultural properties determined to be of particular importance to American Indian groups (in accordance with National Register Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*; Parker and King 1998), or designated for traditional use. Such properties include, (but are not limited to) burial location, pictograph or petroglyph sites, vision quest locations, plant-gathering locations, and areas used for religious purposes or considered sacred.

BLM Manual 8110, *Identifying and Evaluating Cultural Resources*, defines six use categories:

- scientific use,
- conservation for future use,
- traditional use,
- public use,
- experimental use, and
- discharged from management.

As noted in the manual, "A cultural property may be allocated to more than one use category. Allocations shall be reevaluated and revised, as needed, when circumstances change or new data become available" (8110.41A–B).

Cultural resource properties that have been formally evaluated can be assigned to one or more of the BLM resource use classifications, but of the approximately 8,693 cultural resources that have not been formally evaluated for NRHP, eligibility can only be assigned to use classifications in a general or categorical sense.

Scientific Use

Scientific use implies that the value (or a value) of the property lies in information that can be extracted from the property. This use category usually corresponds to NRHP Criterion D, which recognizes the value to society of properties that can yield or have yielded information important in expanding understanding of history or prehistory. Archeological sites are generally evaluated under this criterion, although other kinds of cultural resources might rarely also be evaluated under this criterion. This use category applies to archeological resources that have been determined to be eligible for the NRHP under Criterion D, but it also applies to all archeological resources that have not yet been evaluated for NRHP eligibility. This use category could also apply to historic archeological sites or the archeological components of building complexes or examples of extractive industry. The most significant sites with extractive scientific value might include bison kill sites, sites with buried components, habitation, or earth lodge village sites. Several sites in the planning area are already allocated to scientific use (Table 3-25).

TABLE 3-25.
CULTURAL SITES
CURRENTLY ALLOCATED TO USE

Cultural Resource Use Category	Site
Scientific Use	Yonkee 24PR0005
	Mill Iron 24CT0030
	Taylor-Siegal Site 24DW0011
	Soaring Owl Site 24DW0087
	Mini Moon Site 24DW0085
	Deadman Site 24CR0297
	Jordan Bison Kill 24GF0271
	Rosebud Battlefield[1] 24BH2461
	Battle Butte and Wolf Mountain Site[1] 24RB0787
	Reynolds Battlefield[1] 24PR0089

[1]***Record of Decision, Oil and Gas Amendment, Billings-Powder River-South Dakota Resource Management Plans/Environmental Impact Statements***

Conservation for Future Use

This use category pertains to all cultural resources regardless of age or thematic associations, unless the resources have been formally determined to be ineligible for the NRHP under all of the NRHP Criteria for Evaluation. Sites that could be of scientific value but are not immediate candidates for study under the scientific use category will be managed under the conservation for future use category. Because it is not feasible for the MCFO to test all archeological sites and otherwise evaluate the NRHP eligibility of all of the recorded cultural resources in the planning area, conservation for future use effectively results in monitoring of other public land uses, evaluating specific proposed activities that might disturb specific cultural resources, controlling erosion of the resources, and actively stabilizing the resources as appropriate.

Rock art sites fit this category, particularly in terms of research potential and singular cultural importance. With few exceptions, rock art sites should be managed for conservation. Similarly, rock shelter sites also should be managed for conservation because of their potential to preserve exceptional chronological data in cultural deposits and include unique artifact types, as should ceremonial sites (such as the Long Medicine Wheel site)

(24MC0148) and battlefield sites (such as the Reynolds (24PR0089), Wolf Mountain and Battle Butte (24RB0787), and Cedar Creek (24PE0261) Battlefields, Powder River Depot (24PE0231), and Mouth of the Redwater fight site) (no site number). Other sites that would also qualify for allocation to conservation for future use include the Yonkee site (24PR0005), Mill Iron site (24CT0030), Taylor-Siegal Site (24DW0011), Soaring Owl Site (24DW0087), Mini Moon Site (24DW0085), Deadman Site (24CR0297), Big Sheep Mountain site (24PE0210) and ACEC, Hoe site (24PE0263) and ACEC, Jordan Bison Kill site (24GF0271) and ACEC, Seline site (24DW250) and ACEC, and the Yonkee site (24PR0005) and proposed ACEC and Mill Iron site (24CT0030) and proposed ACEC.

Traditional Use

Traditional use of cultural resources is interpreted as the use of the cultural resource by a specific social or cultural group that perceives the resource as important to its heritage. Cultural resources can include TCPs, which are properties critical to a living community's beliefs, customs, and practices. TCPs can be topographical features; stone alignments, rock art, or other physical artifacts; sources of plants or other materials; or areas without obvious physical manifestation of the site's cultural significance. The regulatory threshold for management of a property as a TCP is eligibility for listing on the NRHP under any of the Criteria for Evaluation, although Criterion A is most commonly appropriate for representation of an event or broad pattern in history. No resource has been specifically identified in the planning area as a TCP as defined in the National Register Bulletin 38 (Parker and King 1998).

TCPs in Montana are most commonly associated with American Indians. Because the tribes of the area were removed to reservations both inside and outside the planning area in the 1870s and 1880s, the ensuing discontinuity of occupation and use of the planning area since then is likely to have resulted in loss of areas of critical importance to some living American Indian communities.

Sites that would be considered to be eligible for consideration for allocation to traditional use and which are also sensitive with regard to their setting include rock art sites, ceremonial sites (such as the Long Medicine Wheel site [24MC0148] and proposed ACEC), battlefields (such as the Reynolds Battlefield site [24PR0089] and ACEC and proposed ACEC, Wolf Mountain and Battle Butte Battlefield site [24RB0787] and ACEC and proposed ACEC, and Cedar Creek Battlefield site [24PE0261] and proposed ACEC), and Mouth of the Redwater and Spring Creek fight sites.

Public Use

Long-term preservation and on-site interpretation are most appropriate for cultural resources with visually obvious manifestations of the site's historical or archeological importance. Although the type of on-site interpretation that invites public access to the site is usually not appropriate for cultural resources that can be easily vandalized or degraded, including most archeological sites that might be important for their scientific

values, some sites are already well known and thus vulnerable to damage. The intent of interpretive efforts is the use of education to help preserve the site and similar examples.

Management under this use category is therefore likely to be driven more by practical considerations than by regulatory requirements. On-site interpretation also is not appropriate for most American Indian TCPs, because of the possible degrading effects of public presence on the setting and feeling of these locations.

Sites that have been considered for allocation to public use include the Lewis and Clark Trail, the Powder River Depot site (24PE0231) and ACEC, Reynolds Battlefield site (24PR0089) and ACEC and proposed ACEC, Wolf Mountain and Battle Butte Battlefield site (24RB0787) and ACEC and proposed ACEC, Cedar Creek Battlefield site (24PE0231) and proposed ACEC.

Experimental Use

The regulatory threshold for managing cultural resources for experimental use is likely to be eligibility under NRHP Criterion D, which involves the likelihood of yielding information important to expanding knowledge of history or prehistory. Archeological sites that could be adversely affected by development or other factors could also be candidates for experimental use as mitigation for the adverse effect. The BLM remains responsible for analyzing and protecting information obtained during mitigation of potential adverse effects to cultural resources. No sites, to date, have been proposed or have been considered for allocation to experimental use in the planning area.

Discharged from Management

This use category would apply to any cultural resource the BLM and the Montana State Historic Preservation Office have determined to be ineligible for nomination to the NRHP or sites that have been removed from BLM administration and management (and federal ownership) through land exchange or have been destroyed from some form of management action, such as coal mining.

The planning area contains approximately 9,934 recorded cultural resources. Of these, some 768 cultural resource sites, determined to be ineligible for nomination to the NRHP, or determined to be non-contributing elements of eligible properties, have been destroyed. According to Manual 8110, sites placed in this use category "remain in the inventory, but they are removed from further management attention and do not constrain other land uses" (8110.42F).

Management Challenges

The BLM's primary challenge is to achieve a balance between protecting valuable cultural resources and simultaneously making other resources available within the context of multiple uses. Pressures on cultural resources will likely increase from continued mineral resource development, and direct and cumulative impacts will continue to degrade a percentage of the cultural landscape. Case-by-case inventory will prevent harm to individual sites, but the lack of comprehensive inventory coverage will continue to hamper broad-scale interpretation and assessment of cumulative effects. Inventories would probably continue at over 100 or more projects per year, with inventories covering approximately 10,000-15,000 acres per year. Impacts to resources for which mitigation measures could not be developed through consultation could be expected to occur once every 5 to 10 years. However, as oil and gas exploration and development increase, the potential conflicts related to cultural resources also will increase.

The demand for consumptive use of cultural resources through tourism and archeological research projects is low but anticipated to increase through time. This reflects an increasing interest in history and recognition of the fragile nature of the resource. Historic trails, particularly those in the national historic trails system, and the Custer Trail, Bismarck to Fort Keogh Trail, and Miles City to Deadwood Stage Trail all could see increased visitation. Maintaining the historic setting is critical to providing a quality experience for visitors. The setting is an essential component in determining whether a particular trail segment contributes to the trail's overall significance, and preservation of the viewshed through a buffer zone is a management goal. Setting is also an

essential aspect of NRHP eligibility for other cultural resource types such as rock art and American Indian sensitive sites and potential TCPs. However, it is not as important for some types of linear sites, such as canals and some roads.

American Indian concerns are becoming increasingly important as development pressures and awareness of four main issues increase. First, the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 et seq.) charges the BLM with establishing the cultural identity of human remains and returning them to the appropriate tribal group or reburying them according to their wishes; implementation of the Native American Graves Protection and Repatriation Act requires the BLM to consult with a broad spectrum of tribal authorities to determine the tribe to which the remains and materials should be repatriated. Second, American Indian religious concerns must be addressed through consultation with various tribes who have or historically had a presence in the area. While certain types of these cultural resources are recognizable by their physical characteristics, others can only be identified by the practitioners of the culture to which they are relevant through the consultation process and on-the-ground site visits. Third is the identification of areas in which Indian traditional practitioners collect plants or minerals. Finally, the issue of ensuring access to areas of traditional importance, as provided for by American Indian Religious Freedom Act (42 U.S.C. 1996). In some cases, these resource areas might also be eligible TCPs, requiring full compliance with NHPA, Section 106.

CULTURAL RESOURCES, CONDITION AND TREND

The diversity of terrain, geomorphology, access and visibility, and past and current land use patterns cause considerable variation in the condition and trend of cultural resources in the planning area. Recorded sites are manifest by exposed artifacts, features, or structures; therefore, they are easily disturbed by elements such as wind and water erosion, animal and human intrusion, natural deterioration and decay, and development and maintenance activities.

Based on limited site monitoring, site-form documentation, and other information, site conditions in the planning area are trending downward. Active vandalism or collecting (unauthorized digging and pothunting) has been observed in limited instances, but is not currently endemic. Consequences of development and maintenance activities (e.g., erosion, grazing, mining, and recreation) are affecting a limited number of site locations, but the most pressing concern is the natural deterioration and decay of standing structures at historic mining and homesteading sites and prehistoric wickiups. Collectively, these agents adversely affected many known cultural resources and continue to do so today. Within the planning area, the demand for cultural resources is considered moderate; this determination is based on known research interests of area scholars and other professionals, interest expressed by members of the American Indian and local communities, documented site conditions, and site visitation. Many interpretive opportunities are also present to provide educational and recreational benefits.

PALEONTOLOGICAL RESOURCES

Paleontological resources are defined as “any fossilized remains, traces, or imprints of organisms, preserved in or on the earth’s crust, that are of paleontological interest and that provide information about the history of life on earth…” (16 U.S.C. 470aa). Paleontological resources as defined do not include any paleontological resources found in context with archeological and cultural resources. These are covered under other Federal laws.

The planning area contains some of the richest paleontological resources in the world; nearly every major museum in the United States has at least one dinosaur exhibit from this area. The Hell Creek formation contains the best examples of the last period of the age of dinosaurs in the United States, and, together with the Tullock member, exhibits an uninterrupted sequence encompassing the last era of the dinosaurs, their extinction, and the subsequent beginning of the age of mammals. Beginning in 1903, these formations have been the subject and source of much research. There are other areas containing high concentrations of significant paleontological values; many of these individual localities will also continue to produce significant amounts of paleontological data.

The source of paleontological value in the planning area is attributed to a combination of factors and most important is surface exposure of fossil-bearing strata. Because most fossils are recovered as scattered surface finds, visibility of the outcrop is an important factor in fossil recovery. The climate in eastern Montana often exposes, instead of covering, these units. Lack of vegetative cover also enhances the visibility. Exposures that produce significant fossils, particularly vertebrate fossils, are rare, and therefore, are of considerable scientific value and interest. Several sites in the planning area have yielded the only known fossil record for various extinct animals.

On average, MCFO issues approximately 10 to 15 paleontological resource use permits for surface collection and excavations to qualified researchers on an annual basis. Typical excavations cover approximately 0.5 acres and combined, they contribute to between 5 to 7.5 acres being disturbed annually. There are 1,805 vertebrate fossil localities (all ownerships) and 124 non-vertebrate localities in the planning area. Non-vertebrate localities include 68 plant, 51 invertebrate, 1 plant and invertebrate, and 4 trace fossils (Aaberg et al. 2006). Of the 1,929 paleontological localities recorded in the planning area, 1,440 (75 percent) occur on BLM-administered land, 278 (14 percent) on private land, 153 (8 percent) on state land, 7 (less than 1 percent) on USFS land, 1 (less than 1 percent) on United States Army Corps of Engineers land, 1 (less than 1 percent) on other federal land, and 1 (less than 1 percent) on lands administered by both the state and BLM. Landowner information for 48 of the paleontological localities (3 percent) is unknown because of ambiguous legal descriptions. In the planning area, approximately 95 percent of the paleontological localities occur in counties where most of the Hell Creek and Fort Union formations outcrop; this includes portions of Garfield, Carter, Dawson, McCone, Powder River, and Treasure.

In the planning area, paleontological resources are strongly associated with the upper Cretaceous Hell Creek formation (where 80 percent of known locations in the planning area occur). The Tertiary Fort Union formation contains 14 percent of known paleontological localities. All other strata in eastern Montana contain less than 2 percent each of documented fossil localities.

In Montana, the Judith River formation represents deposition in a shallow sea and on a coastal plain that contained river channels, freshwater swamps, and lakes. In addition to plant remains, many animal species are found in this formation, including mollusks, fish, amphibians, lizards, dinosaurs, other reptiles, and small mammals.

Meandering river channels and freshwater swamps that developed on broad delta plains were prevalent during the deposition of the Hell Creek and Lance formations (Flores 1992). The fossil record indicates a tropical to subtropical climate that supported a wide diversity of plant species. Mollusks, fish, amphibians, reptiles, dinosaurs (Triceratops, Anatosaurus, and Tyrannosaurus), other reptiles, birds, and small mammals are all abundant in the Hell Creek fossil record. Fossils from the Hell Creek formation and Tullock member, particularly in Garfield and McCone counties, are instrumental in studies examining the mass extinction event represented at the Cretaceous-Tertiary boundary (Clemens 2002).

The Fort Union formation is divided into three members in ascending order: the Tullock, Lebo, and Tongue River members. A wide variety of plant fossils are found throughout the Fort Union formation and indicate an environment characterized by an alluvial plain that contained river channels, expansive flood-basin swamps, and lakes (Belt, Sakimoto, and Rockwell 1992). Channel fill deposits contain an abundance of freshwater clams and snails, while the most significant fossils (turtle, fish, reptile, and mammal) are found primarily in the Tullock member of the Fort Union formation. The Tullock member contains fish, amphibian, turtle, champsosaur, lizard, crocodilian, mammal, bird, and plant remains.

The Miocene Arikaree formation has produced fish, bird, and mammal fossils. This formation has a low fossil potential, but there is a high probability that its fossils would be considered significant (Aaberg et al. 2006).

TABLE 3-26.
FOSSIL-BEARING ROCKS AND THEIR ACREAGE
ON PUBLIC LANDS IN THE PLANNING AREA (Map 24)

Geologic Rock Unit	Percentage of Formation on Public Lands	Acres of Public Lands
Judith River formation	2.60	8,025
Hell Creek formation	16.26	421,441
Lance Formation	0.64	4,303
Fort Union Formation (Tullock Member)	13.98	347,589
Arikaree Formation	2.37	760
Total		**782,118**

SPECIMEN COLLECTION

Existing regulations and policies address the fossil collection on public lands (BLM IMs 2008-25, 2009-11, and 2012-140 and 12-41 and Handbook H-8270). Some areas may be closed for hobby collecting to protect scientifically significant invertebrate or plant fossils or to prevent other potential resource damage. Although qualified paleontologists may obtain permits for collecting vertebrate fossils and other scientifically significant specimens, specimens collected under the backing of a permit remain the property of the federal government and must be kept properly in a qualified museum or university collection.

Subject to consistency with other laws and policies, casual collecting of common invertebrates and plant fossils would be allowed in the planning area. Permits would be required for the collection of paleontological resources (vertebrate fossils). Commercial collecting would not be allowed or permitted.

Paleontological Resources, Condition and Trend

Paleontological localities are subject to damage, destruction, or loss from surface disturbance associated with commercial construction or development projects but also from amateur collectors and rock hounds. Although some of these enthusiasts are aware of the scientific value of their finds, many are not. Although interest in vertebrate fossils draws many people into the field of fossil collection, demand fueled by high prices obtained for some fossil specimens also generates interest. Specimens collected for sale to the public often lose their scientific value because important, associated data regarding the location and context are not recorded or preserved and the specimens are often not made available to the scientific community.

The scientific value of a fossil specimen can be diminished by improper recovery, improper reconstruction and storage, or by failure of the collector to record precise location and stratigraphic data in the field. Damage or destruction of paleontological resources, an inherently nonrenewable asset, results in the permanent loss of these resources for future scientific research or public enjoyment. Because dirt bikes and all-terrain vehicles (ATV) have damaged some fossil localities, inadvertent damage is a concern. OHV use continues to provide access to remote outcrops and collecting localities. These sites are vulnerable to destruction by off-road travel. Motorized wheeled travel allows vandalism of fossils that might otherwise be too heavy or awkward to pack out on foot (BLM 2003m). Compounding the factors described above, a significant amount of land administered by BLM represent badlands topography, resulting in large exposures of strata and contributing to a higher probability for the discovery of fossil localities.

The condition and trend of paleontological resources in the planning area varies considerably because of past and present land use patterns and diversity of terrain, geomorphology, access, and visibility. Exposed fossil elements can be easily damaged by numerous factors, including wind and water erosion, animal and human intrusion, natural deterioration, and commercial development and maintenance activities. Evidence of vandalism or illegal collecting has been observed on limited occasions in the planning area. Commercial development and maintenance activities (e.g., accelerated erosion attributable to some grazing, mining, and recreation activities) are known to affect certain fossil localities.

In the planning area, there are several National Natural Landmarks (NNLs) and ACECs that recognize significant paleontological areas (see *Special Designation Areas*). NNLs include Hell Creek, Bug Creek, and Capitol Rock and ACECs include Hell Creek, Bug Creek, Sand Arroyo, and Ash Creek Divide. Proposed ACECS for paleontology include Flat Creek and Powderville or those with paleontological components, Long Medicine Wheel and Walstein Reservoir.

Based on known research interests of professional paleontologists and the increase in private-prospecting arrangements throughout the planning area, the demand for paleontological resources is considered high to very high in the planning area.

VISUAL RESOURCES

INTRODUCTION

With the exception of a few large parcels, BLM administered lands in the planning area are scattered among private, local, state, and other federally managed lands. Rolling hillsides are the dominant landscape but there are also isolated rock outcrops, woody draws, forested coulees, ponderosa pine, juniper stands, riparian, wetlands, hardwood river bottoms, badlands, and river breaks. All possess unique visual qualities, character, and natural beauty.

The planning area still maintains much of the scenic quality and pristine viewsheds encountered over the past 25 years. The prevalence of grazing in the planning area and the open spaces afforded by an agricultural economy have helped prevent major change to date.

There have been visual intrusions involving concentrated development such as buildings, infrastructures associated with oil and gas fields and CBNG development, and ROWs involving surface disturbance (e.g., utilities). Visual mitigation of these activities has prevented development activities from exceeding the established VRM objectives within these areas. Other visual intrusions, such as range improvements, fences, two-track roads, and areas receiving concentrated recreational use, are located throughout the planning area.

Public lands have a variety of visual values, warranting differing levels of management. The objective of the VRM program is to manage public lands in a manner that will maintain their scenic quality. BLM is responsible for ensuring scenic values are considered before allowing uses. To determine their scenic value, public lands are inventoried, values are rated, and objectives established for each rating.

INVENTORY

The public lands in the planning area were inventoried for their scenic values. A scenic quality evaluation was done to rate the visual appeal of an area; a sensitivity level analysis to assess public concern; and a delineation of distance zones to indicate the relative visibility of the scenic value from primary travel routes or observation points. Based on these three factors, BLM-administered surface lands were placed into one of four inventory classes: Class I, Class II, Class III, and Class IV; with Class I having the most scenic value and Class IV having the least.

MANAGEMENT

Inventory classes indicate the scenic value of an area, but do not establish management direction. Management options are considered and determined in the RMP (see Chapter 2, Visual Resources section). The planning area currently contains the following BLM administered VRM areas:

- VRM Class I: 97,000 acres,
- VRM Class II: 400,000 acres,
- VRM Class III: 380,000 acres; and
- VRM Class IV: 1.9 million.

The management objective for VRM Class I is to preserve the existing landscape. The VRM Class I areas within the planning area include five wilderness study areas (WSAs). VRM Class II management objective is to retain the existing character of the landscape. VRM Class II areas in the planning area are river corridors of the Yellowstone, Missouri, and Powder rivers, large areas abutting the Charles M. Russell National Wildlife Refuge, and the Finger Buttes ACEC in Carter County. Interstate 94 and State Road 12, both VRM Class II landscapes, are the major east-west transportation routes for tourists and residents, providing access to recreation opportunities and views along the rivers. The Lewis and Clark Special Recreation Management Area (SRMA), which includes lands next to the Yellowstone River and portions of the Missouri River, are also within a VRM Class II area. VRM Class III management objective is to partially retain the existing landscape. The management objective for VRM Class IV is to provide for management activities that require major landscape modification. The majority of the planning area is VRM Class III and IV.

LANDS WITH WILDERNESS CHARACTERISTICS

The BLM reviewed and updated the wilderness inventory for public lands outside of designated Wilderness Study Areas, 51 areas were assessed for the presence of wilderness characteristics. Pursuant to 40 CFR § 1502.21, the BLM hereby incorporates its wilderness inventory update by reference. These documents are available for review at the Miles City Field Office and on the planning Websites:
http://www.blm.gov/mt/st/en/prog/lands_with_wilderness/miles_city_field_office/miles_city_fo_north.html
http://www.blm.gov/mt/st/en/prog/lands_with_wilderness/miles_city_field_office/miles_city_fo_south.html

The wilderness inventory update considered the standard wilderness criteria of size, naturalness, and outstanding opportunity for solitude or primitive, unconfined recreation as described in Section 2(c) of the Wilderness Act. The BLM used multiple information sources to complete the wilderness inventory update, including an in-house interdisciplinary team with field knowledge of the areas, aerial photographs, BLM databases containing records of rights-of-way, mineral leases, mining claims, road improvements, and vegetation treatments.

BLM staff made site visits to the field where more information was needed to validate their inventory findings and to follow up on public comments regarding wilderness characteristics. In addition, 7 citizen based inventories received during the public comment period on Draft Miles City RMP were evaluated, site visits were conducted, and summaries are contained below. Complete inventory reports including maps, inventory evaluation forms, and road analysis forms were completed for each BLM inventory unit.

The following summarizes the BLM's wilderness characteristics inventory update findings.

Wilderness characteristics were found on all acres of the following inventory units**:**

Devils Creek, Ridge, Wrangler Creek, Rough Creek, Whitetail.

Wilderness characteristics were not found to exist in the following inventory units**:**

Buck Creek, Corral Creek, Deadhorse, Wildhorse, East Dry CreekWest Cabin Creek, Gilbert Creek, West Haxby, Ryan Coulee, Struple Coulee, Hungry Creek, East Carin Butte, Lost Creek, Big Dry, West Wild Horse, East Wild Horse, South Lonetree, LS Creek, Huey Creek, Whitney Creek, South Fallon, Cedar Creek, North Fallon, Cherry Creek, South Timber Creek, Homestead, West McCloud, Custer Creek, East Haxby, Curry Coulee, Sheep Mountains, Timber Creek, Cairin Butte, Lisk Cherry, Terry Badlands, Hubbard Area, Gay Ranch/Home Unit Exchange, Pine Creek, North Horse Creek, Snow Creek, North Butte Creek, West Crow Creek, Blacktail, Butcher Hills, Thompson Creek, Hammond Valley Island, Bradshaw, Pumpkin Creek, and East Haxby

A total of 28,841 acres (outside of areas previously identified as Wilderness Study Areas) of BLM managed lands were found to contain wilderness characteristics. Detailed inventory findings are contained in the above referenced inventory files. Of the 7 citizen proposals for new lands with wilderness characteristics received by BLM, the BLM inventory update found wilderness characteristics to be present on all or portions of 4 of

the citizen proposed areas, 3 areas were determined by BLM to lack wilderness characteristics and eliminated by BLM. This was primarily due to the presence of roads, major developed, pipeline rights-of-way, power line rights-of way, irregular size, or human activities not identified in the citizen proposals. The impacts of these activities were substantially noticeable and/or had several impacts where there was a cumulative effect on an areas naturalness, solitude, or primitive and unconfined recreation.

Summary comparison of Citizen's Proposed Lands with Wilderness Characteristics and BLM's Findings:

- **ROUGH CREEK UNIT** - The citizen proposal contained an established county road. Due to the county road, the area south of the county road was removed from consideration. The remaining 5,302 acres were determined to meet the criteria for lands with wilderness characteristics.

- **WRANGLER CREEK UNIT** – The citizen proposal contained a BLM maintained road and a maintained county road. This resulted is a boundary modification that resulted in the reduction of 1,541 acres from the citizen based proposal. The reduced acres did not meet the size criteria or the exception to the size criteria. The remaining 5,309 acres were determined to meet the criteria for lands with wilderness characteristics.

- **DRY CREEK UNIT** - This citizen proposal was divided due to the presence of a road bisecting the unit and that the units were each of sufficient size to warrant evaluation. The two areas evaluated as part of the review for the citizen proposed Dry Creek Unit included the Whitetail and East Dry Creek Unit. The Whitetail Unit, which was comprised of 4,808 acres west of the road was found to meet the criteria for lands with wilderness characteristics and met the exception for lands less than 5,000 acres. The Whitetail unit contains rugged breaks, ponderosa pine, and juniper providing both naturalness and vegetative screening for recreationists to experience solitude during a primitive activity. The East Dry Creek Unit (4,392 acres) was determined to not meet the criteria or exception for size but was still evaluated since the other portion of Dry Creek (Whitetail) contained wilderness characteristics. East Dry Creek was found to lack vegetative screening and have limited topographical relief; this combined with the small size does not provide an outstanding opportunity for solitude. Primitive and unconfined recreational activities would not be compatible with primary recreational activities using motorized vehicles in the area.

- **CORRAL CREEK UNIT** - The Corral Creek Unit was found to be dissected by three BLM/public maintained roads, two major pipeline rights-of-ways, and a large portion of acreage having been contour furrowed which prompted a boundary modification to eliminate these human caused impacts from the unit. The boundary modification, which eliminated the above features, resulted in 31,699 acres dropped off the citizen submitted Corral Creek Unit. The remaining area was named the Ridge Unit (8,184 acres) and was determined to meet the criteria for lands with wilderness characteristics.

- **DEAD HORSE UNIT** - The Dead Horse Unit was found to have major developed rights-of-ways pipelines which bi-sected the unit; BLM regularly maintained roads; multiple range improvement projects; and is within the Powder River Military Operating Area (MOA), which includes low-level training flights. The pre-dominant recreational activity in the area is hunting. Hunting areas are typically accessed by motorized vehicles from a county road and then from the route network throughout the unit. Portions of the unit are outfitted for hunting and guides, who use motorized equipment on established roads for accessing the area. In addition, motorized access to State of Montana inholdings for items such as agriculture leases exist in the unit. The combination of human uses, associated noise levels, lack of vegetation or topographical screening makes it difficult to escape the sights and sounds of civilization, making the area incompatible with providing outstanding opportunities for primitive recreation and solitude. The Dead Horse Unit was determined not to have outstanding opportunities for solitude or primitive and unconfined recreation due to the amount and distribution of substantially noticeable developments and based on impacts related to the MOA, as well as motorized use impacts within the unit.

- **WILDHORSE UNIT** - The Wildhorse Unit did not meet the size criteria of a roadless area with over 5,000 acres of contiguous BLM-administered lands, as it is only 4,550 acres. However, the unit was still inventoried to determine if the area met the exceptions to the size criteria. This unit has two utilized BLM roads which allow motorized OHV use through the unit via Montana State Highway 24. These roads divide the unit into two distinct smaller areas which do not meet the size criteria.

- **BUCK CREEK UNIT** - The Buck Creek Unit inventory was determined to not meet the naturalness criteria due to the accumulation of human uses/activities including several range improvement projects such as fences, reservoirs, water pipelines, water tanks, wells, windmills and fences that are substantially noticeable. Other uses which limit the unit's naturalness include an abandoned oil pad, roads and blade lines from recent fire activities and three routinely maintained BLM roads which have easements in place for regular public access.

RESOURCE USES

FORESTRY AND WOODLAND PRODUCTS

Coniferous forest habitat types occurring in the planning area include ponderosa pine (*Pinus ponderosa*), Rocky Mountain juniper (J*uniperous scopulorum*), Douglas-fir (*Pseudotsuga menziesii*), and limber pine (*Pinus flexilis*). Deciduous forest habitat types include green ash (*Fraxinus pennsylvanica*), quaking aspen (*Populus tremuloides*), boxelder (*Acer negundo*), and bur oak (*Quercus macrocarpa*) (Hansen, Thompson, Massey, and Thompson 2008). Ponderosa pine forest types occur on the majority of the planning area forestlands.

Moisture (along with soil type, nutrient availability, plant density, topography, and climate) is one of the most important factors affecting plant growth. Lack of moisture can have a pronounced influence on overall productivity. This is particularly true in the dry expanses of the Northern Great Plains. In the planning area, the habitat types of the ponderosa pine series occur along a moisture gradient (where the graminoid-dominated habitat types are drier than the shrub-dominated habitat types). Within the graminoid-dominated habitat types, the following moisture gradient is present (from dry to wet) (Hansen et al. 2008):

- ponderosa pine/bluebunch wheatgrass habitat type,
- ponderosa pine/sun sedge (*Carex heliophila*) habitat type, and
- ponderosa pine/Idaho fescue (*Festuca idahoensis*) habitat type.

Within the shrub-dominated habitat types, the following moisture gradient is present (from dry to wet) (Hansen et al. 2008):

- ponderosa pine/white coralberry (*Symphoricarpos albus)* habitat type,
- ponderosa pine/common juniper (*Juniperus communis*) habitat type,
- ponderosa pine/chokecherry (*Prunus virginiana*), and
- ponderosa pine/red-osier dogwood (*Cornus stolonifera*) habitat type.

There are six distinct geographic or geologic areas where most of the forestlands occur in the planning area (geological characteristics generally define the location of forestlands). These six distinct areas are described below (Table 3-27).

(1) The Missouri Breaks in Garfield County
This area is characterized by two distinct conditions: areas with exposed shale dominated by Rocky Mountain juniper with scattered ponderosa pine and knobs of deeper soils dominated by ponderosa pine and scattered Douglas-fir trees.

(2) Areas south of the Yellowstone River
This area has forestlands on knobs where soils are loamy with a high percentage of coarse fragments. Soils are shallow to deep, and elevations vary from 2,300 feet in the areas southwest of Miles City to

4,200 feet near the Wyoming border. Areas east of Miles City (Knowlton and Pine Hills) along the Powder River have slightly higher elevations and higher precipitation than the Rosebud County area. Areas in western Custer County and eastern Rosebud County have the lowest elevations and precipitation. This area includes the Moon Creek and Rosebud Creek drainages.

(3) Ekalaka Hills-Chalk Buttes in Carter County

These areas have generally sandy soils developed from sandstones and siltstones and a medium percentage of coarse fragments. Precipitation averages 16 to 18 inches per year and elevations range from 3,500 to 4,100 feet.

(4) Cedar Creek Anticline

This area of exposed shale is located between Baker and Glendive. Juniper habitat types are present, and juniper is the dominant cover type.

(5) Terry Badlands

This area is located north of the Yellowstone River near Terry and contains a unique cover type of limber pine that also contains ponderosa pine and Rocky Mountain juniper.

(6) Areas north of the Yellowstone River

This area is located north of the Yellowstone River with scattered ponderosa pine and juniper trees occurring on sandy loam soils.

TABLE 3-27.
FORESTLANDS BY GEOLOGIC OR GEOGRAPHIC AREA

Area Name	BLM-administered Acres of Forestlands Within Areas			BLM-administered Acres of Forestlands Available for Treatment (outside of WSAs)		
	Conifer	Hardwood	Total	Conifer	Hardwood	Total
Ekalaka Hills/Chalk Buttes	2,607	2,233	4,840	2,607	2,233	4,840
South of Yellowstone	56,383	35,180	91,563	52,257	34,749	87,006
Cedar Creek Anticline	9,228	3,168	12,396	9,228	3,168	12,396
Missouri Breaks	35,677	8,293	43,970	26,981	7,091	34,072
North of Yellowstone	3,372	10,655	14,027	3,372	10,655	14,027
Terry Badlands	212	308	520	15	82	97
Total	**107,479**	**59,837**	**167,316**	**94,460**	**57,978**	**152,438**

USFS and USDI (LANDFIRE) data

Fire Regime/Condition Class (FR/CC) is an interagency, standardized tool for determining the degree of departure from reference condition vegetation, fuels, and disturbance regimes (Hann et al. 2008). The FR/CC describes the differences between current vegetation composition and structure and pre-European settlement reference conditions. Assessing FR/CC helps guide management objectives and set priorities for treatments.

Based on percentage departure from average pre-settlement reference conditions, the FR/CC is divided into three categories:

- FR/CC 1: 0 to 33 percent departure;
- FR/CC 2: 34 to 66 percent departure, and
- FR/CC 3: 67 to 100 percent departure.

Forests and woodlands in FR/CC 1 have frequent fire return intervals and stand structures characteristic of pre-

settlement conditions. Both forest and fire management activities designed to reduce ladder fuels and understory vegetation buildup lower the FR/CC of a treatment area. Forests and woodlands in FR/CC 1 are productive, diverse, vigorous, and resilient to disturbances (e.g., wildfire, insects, and disease). These areas typically experience insect and disease activity at endemic, not epidemic levels. In contrast, forests and woodlands in FR/CC 2 and FR/CC 3 are overstocked and experience infrequent fire return intervals. Species compositions and dense stand structures are uncharacteristic of pre-settlement conditions and trees experience increased competition for growing space (e.g., sunlight, water, nutrients); therefore, these forests and woodlands are less resilient to disturbances and are at risk of stand-replacing wildfires, epidemic level insect and disease outbreaks, or both.

Fire was a key element in shaping ponderosa pine forests in the planning area prior to European settlement. Historically, forested areas of southeastern Montana experienced fire return intervals of 35 to 40 years (Arno and Gruell 1983). High-frequency, low-intensity fires kept forests open and park-like and removed competing understory vegetation and down material, which resulted in irregularly shaped patches and groups of trees that varied in age, size, and density across the landscape. However, fire suppression since the early 1900s have resulted in most forest types and woodlands being classified in FR/CC 2 and FR/CC 3 (Map 25) categories, which deviate from the pre-European settlement Historic Range of Variability (Clark and Sampson 1995) for species composition, stand structure, fire frequency and intensity, and fire size. Fire suppression practices have caused changes that include:

- reduced tree growth,
- stagnated nutrient cycles,
- increased risk of insect and disease activity,
- increased hazardous fuel loadings,
- increased vertical fuel continuity,
- changes in canopy cover and increased stand density,
- increased risk and severity of wildfires,
- fewer and smaller canopy openings,
- shifts in habitat diversity, and
- changes in visual appearance and aesthetics.

Climate strongly affects forest productivity and species composition. In addition to the direct effects of climate on tree growth, climate also affects the frequency and intensity of natural disturbances such as fire, insect outbreaks, ice storms, and windstorms. Because different species may respond somewhat differently to warming, the competitive balance of species in forests may change. Trees will probably become established in formerly colder habitats (more northerly, higher altitude) than at present (Backlund et al. 2008).

Climate change also affects insect populations that damage and kill trees. When climatic conditions cycle into warmer and drier trends, beetle populations are favored with less winter mortality and faster and better reproductive cycles (Kolb 2009). According to Diana Six, an entomologist at the University of Montana, "A couple of degrees warmer could create multiple generations a year…If that happens, I expect it would be a disaster for all of our pine populations" (Robbins 2010, n.p.). Jesse Logan, a research entomologist for the USFS Rocky Mountain Research Station, built on the work of other beetle researchers and created a complex computer model of bark beetle behavior. The model showed that cold temperatures at higher elevations made it impossible for mountain pine beetles to complete their life cycle in 1 year, forcing them to confront a second winter at a vulnerable point in their development, thereby keeping beetle populations at relatively low levels. However, when Logan increased the global mean temperature by 2 degrees in the model, beetles raced through a 1-year life cycle at higher elevations. According to Logan, "they also synchronized their emergence, allowing them to join forces and overwhelm tree defenses. High-mountain mass attack – and mass tree death – suddenly became possible" (Nijhuis 2004, n.p.)

Plains island forests (refugia of trees and tree-dependent species isolated in a grassland matrix) are at significant risk from climate changes because they are ecotone systems (borderline between grassland and forest ecosystems) and therefore sensitive to relatively small changes in environmental conditions. In addition,

because island forests are relatively small ecosystems, they may exhibit reduced genetic diversity and greater vulnerability to catastrophic disturbance such as wildfire, pathogen attacks, or severe drought (Henderson, Hogg, Barrow, and Dolter 2002).

The issue of climate change exacerbates the current forest health problem in southeast Montana. Forest and woodland health within the planning area will continue to deteriorate without implementation of silvicultural treatments to reduce fuel accumulations and restore existing stands to desired conditions by improving the overall vigor, productivity, and resiliency of forested vegetation. Low-intensity prescribed burns and thinning of small diameter trees would be an important management tool for ponderosa pine stands. Such activities reduce fuel loads and ladder fuels, decreasing the likelihood and intensity of crown fires, aiding nutrient cycling, and improving seedbeds and productivity of understory species (Howard 2003).

FOREST PRODUCTS

Most forested lands in the planning area occur in small isolated parcels with poor access, low volumes per acre, and limited values. Consequently, the sale and harvest of wood products has primarily occurred through small, negotiated sales.

Forest products harvested within the planning area have historically accounted for less than 5 percent of total harvest volume in Montana (Keegan et al. 2001). Most harvesting has occurred on private ownerships and been supplemented by harvests from federal, state, and tribal lands. Since 1999, annual harvest levels from private lands within planning area counties have averaged 22 million board feet, representing approximately 73 percent of total harvest volume (S. Hayes, personal communication, May 17, 2010). The predominant product harvested has been sawlogs and other commercial products reported include house logs, pulpwood, residue (biomass), veneer logs, and post and poles. Most forest products are exported out of the planning area for processing in western Montana, Wyoming, and South Dakota because southeast Montana lacks a wood product manufacturing infrastructure. However, transportation costs to deliver products to these long distance markets are generally prohibitive.

Forest product usage has been incidental on BLM-administered lands. Since 2000, four commercial timber sales (totaling 1,787,000 board feet) were harvested from BLM-administered lands. About 60 permits per year have been issued for other forest products; including Christmas trees, fuel wood, and post and rail material. Non-sawlog products are typically used by the permittee for personal or ranch use. Sales of house logs, residue (biomass), and veneer logs have not occurred on BLM-administered lands in the planning area.

Biomass

Long distances to pulpwood processing facilities and low-return pulp markets have contributed to sporadic to non-existent use of small diameter forest material. Some of this material has been removed through personal use firewood permits and is directly related to the distance from larger population centers. Use of this material for biomass-related energy production has not been a factor and no such facility currently exists in the region.

LIVESTOCK GRAZING

GRAZING ALLOTMENTS

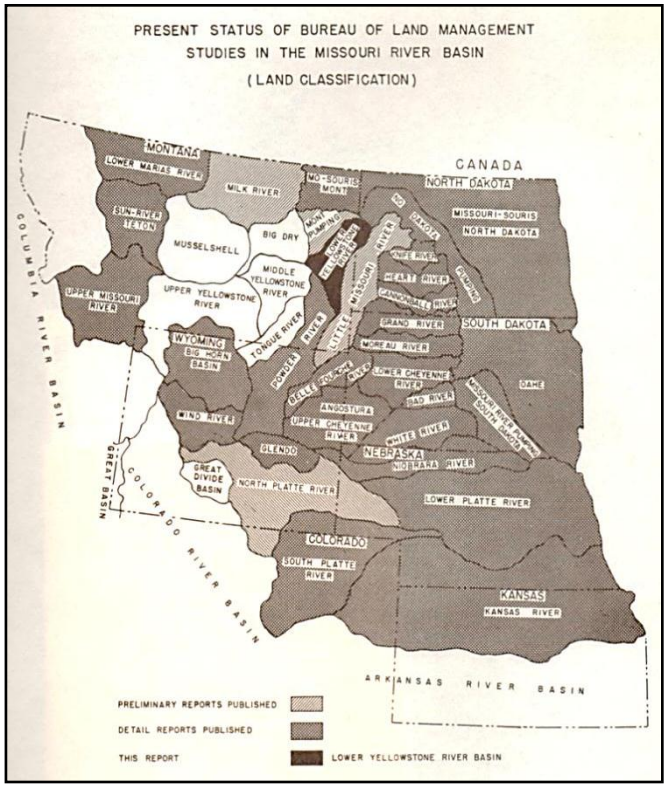
The MCFO is responsible for administering livestock grazing on BLM-administered surface across the planning area. These BLM-administered lands are usually intermingled with private and state lands, which are grazed as one unit. The MCFO administers 1,776 grazing allotments comprising approximately 2,736,673 public acres and 546,570 public AUMs (BLM 2007f). Cattle are the predominant class of livestock authorized, which are generally cow-calf pairs (calves are sold at weaning). Most yearlings are replacement heifers. According to the Rangeland Administration System, permitted allocations include cattle on 1,728 allotments, sheep on 132 allotments, horses on 101 allotments, yearling cattle on 33 allotments, bison on 3 allotments, and burros on 1 allotment (BLM 2007f). There are 34 allotments (2 percent) with more than 10,000 acres, and 1,110 allotments (63 percent) with less than 1,000 acres, while the remaining 632 allotments (35 percent) are between 1,000 and 10,000 acres in size.

GRAZING HISTORY

From 1956 through 1972, the BLM conducted a classification of public lands within the MCFO (Figure 3-9) typically referred to as the Missouri River Basin Surveys. From this effort, eight separate reports were generated, which provided the grazing use by AUMs for all BLM-administered lands at the time of the surveys.

The process to estimate the available forage for livestock grazing was conducted by trained individuals and involved intensive vegetation sampling (clipping, weighing, and ocular estimation). The BLM, in cooperation with grazing advisory boards, used the information to adjust the AUMs allocated to a grazing permit. This cooperative effort resulted in decreases, increases, or no changes being implemented for every grazing permit in the field office. These changes were implemented in a timely manner and completed prior to 1975.

FIGURE 3-9. HISTORICAL BUREAU OF LAND MANAGEMENT STUDIES IN THE MISSOURI RIVER BASIN (LAND CLASSIFICATION)



The MCFO has consisted of two separate resource areas, which eventually became planning areas: the Big Dry planning area and the Powder River planning area. Actions concerning levels of grazing allocation in these areas differed through time.

For the Big Dry resource/planning area (1.18 million acres of BLM-administered lands), the BLM completed the *Big Dry Vegetation Allocation EIS* in 1983. The ROD for this EIS (*Big Dry Area Rangeland Program Summary*, December 1982) further refined grazing allocations and provided that the allocation of vegetation would be 25 percent to livestock and 75 percent to other uses (e.g., wildlife, soil protection, and other uses). The ROD was implemented and grazing permits were adjusted if necessary. These allocations were confirmed in the 1996 *Record of Decision and Approved Big Dry Resource Area Management Plan*.

The BLM completed the RMP ROD for the Powder River resource/planning area (1.32 million acres of BLM-administered lands) in 1985. This ROD mimicked the actions in the Big Dry planning area and specified that the allocation of vegetation would be 25 percent to livestock and 75 percent to other uses (wildlife and watershed protection). The ROD was implemented and is reflected in the 1986 *Rangeland Program Summary for the Powder River Resource Area*.

Since 1986, monitoring data (vegetative condition and levels of use) has been the basis for increasing or decreasing permitted use. Through this process, the MCFO has successfully changed the grazing allocations on allotments to ensure that healthy ecological systems are provided for future generations.

In the early 1980s, the BLM established three categories for allotments to identify areas where management was potentially needed and to prioritize workloads and the use of range improvement dollars. Allotments were categorized as Improve Existing Resource Conditions (I), Maintain Existing Resource Conditions (M), or Custodial Management (C). When allotments in the planning area were originally categorized, resource conditions in some of the allotments placed in the I category were not necessarily in need of improvement. Criteria used to place allotments in the I category included the amount of public land present in the allotment; willingness of permittee to invest in management; opportunities for constructing range improvements; existence of grazing related resource conflicts; allotments with moderate to high forage production potential and production at low to moderate levels; the rancher's or BLM's identification of opportunities for improvement in range condition; static or downward range trends; livestock management's potential improvement through water distribution; seasons of use or other factors; and opportunities for a positive economic return on public investments.

Use of the allotment categorization to prioritize work subsided when Standards for Rangeland Health and Guidelines for Livestock Grazing Management were implemented in 1997. The BLM IM No. 2009-018 has revived use of the allotment categorization and directed offices to use it to prioritize work associated with processing and issuing grazing authorizations (BLM 2008g). Criteria to assign allotment categorization has evolved to ensure land health considerations are the primary basis for monitoring the effectiveness of grazing management and for prioritizing the processing of grazing permits and leases. The MCFO has reviewed allotment categories and will continue to review to determine an allotment's appropriate category. Current categorizations include 918 Custodial (C) allotments, 654 Maintain (M) allotments, and 204 Improve (I) allotments.

There are 156 allotments operating under allotment management plans (AMPs). Of these, 80 are I category allotments, 68 are M category allotments, and 8 are C category allotments (BLM 2007f). These AMPs describe grazing activities designed to meet specific resource objectives and become part of the terms and conditions of a grazing permit or lease.

RANGELAND HEALTH

In 1997, the Montana BLM State Director approved the *Montana/Dakotas Standards for Rangeland Health and Guidelines for Livestock Grazing Management* (BLM 1997c). The MCFO Standards are described below.

- Standard 1: Uplands are in PFC.
- Standard 2: Riparian areas and wetlands are in PFC.
- Standard 3: Water quality meets Montana State standards.
- Standard 4: Air quality meets Montana State standards.
- Standard 5: Habitats are provided for healthy, productive, and diverse native plant and animal populations and communities. Habitats are improved or maintained for special status species (federally threatened, endangered, candidates for this status, or Montana species of special concern).

Guidelines for grazing management are preferred or advisable approaches to grazing management practices, and are provided to maintain or improve resource conditions in upland and riparian habitats available to livestock grazing.

Assessments of Standards for Rangeland Health include evaluations of rangeland conditions through the comparison of existing conditions to the parameters for sites according to NRCS Ecological Site Descriptions. Assessments include the soil and vegetation characteristics and impacts of management on native species conditions, including greater sage-grouse. Ecological Site Descriptions include considerations for vegetation structure, composition, and habitat characteristics that would be expected for specific sites based on soils and precipitation.

If Standards for Rangeland Health are not met and livestock grazing determined to be the causal factor, regulation directs the authorized officer to implement actions (e.g., permit modifications, range improvement projects) prior to the next grazing season that will move the allotment towards meeting the Standards for Rangeland Health (43 CFR 4180). Permit modifications include changing season of use, changing type of livestock, addressing carrying capacity, directing salt and mineral placement. Range improvement projects include both structural and nonstructural types. Examples of structural improvements include fences and water developments, and examples of nonstructural improvements include prescribed fire or seedings. Range improvement projects are not only used to improve livestock grazing management, but also to improve watershed conditions and enhance wildlife habitat. The design of range improvement projects addresses wildlife habitat needs in the project-planning process. The MCFO has completed the assessment of all of its allotments in relation to the Standards for Rangeland Health. Actions have been implemented in the 41 allotments (2 percent) determined to be not meeting one or more of the Standards for Rangeland Health.

RANGELAND MONITORING

The BLM conducts rangeland monitoring and land health evaluations to determine compliance with Standards for Rangeland Health (or progress toward these standards) or AMP objectives. If monitoring indicates that progress is occurring, or standards and objectives are being met, management continues. However, if progress is not shown, management adjustments are made. Adjustments are made by agreement or decision through consultation, cooperation, and coordination with permittees and the interested public in accordance with legislation, regulation, and policy.

During periods of drought, monitoring is used to assess allotment conditions. The BLM's 2013 *Policy for Administering Public Land Grazing in Montana, North and South Dakota During Periods of Drought* describes how efforts will first be directed toward allotments with resource concerns, such as sage grouse habitat. Climate change effects to grazing are addressed during allotment monitoring and inspections for land health standards in coordination with the grazing permit renewal process.

MINERALS

GEOLOGIC RESOURCES

The planning area is located along the eastern portion of Montana within the western part of the Great Plains Geologic Province. The Great Plains Province extends from the Dakotas into the eastern portions of Montana, Colorado, and Wyoming. The sedimentary basins within the Great Plains Province have accumulated sediments several miles in thickness; these sandstones, shale, limestones, and coals provide reservoirs for Montana's fossil energy resources of oil, natural gas, coal, and CBNG (ALL 2001b).

The two most important geologic structural features in the planning area are the Williston and Powder River basins (Map 26). The Powder River Basin is bound to the west by the Bighorn Uplift, to the southwest and south by the Casper arch, Laramie Mountains, and Hartville Uplift, and to the east by the Black Hills Uplift. The Miles City Arch and Cedar Creek Anticline are structural features that occur within the planning area and that separate the Powder River Basin from the Williston Basin. The Williston Basin is bound on the east and

southeast by the Canadian Shield and Sioux uplifts, to the west and southwest by the Black Hills Uplift, Miles City Arch, and Porcupine and Bowdoin domes (J.A. Peterson 1996).

POWDER RIVER BASIN

The Powder River Basin covers about 12,000 square miles, with the smaller portion in Montana (Ellis et al. 1999). The Powder River Basin formed through Laramide tectonics that uplifted the area to the west and, subsequently, these uplifted areas contributed sediments to the basin during the Late Cretaceous and Early Tertiary periods. The Powder River Basin is asymmetrical in shape with the strata dipping toward the basin axis, which trends northwest to southeast and is located near the western basin margin (Ellis, Stricker, Flores, and Bader 1998). The strata dip away from the surrounding topographic highs of the Bighorn Uplift to the west, the Casper Arch, Laramie Mountains, and Hartville Uplift to the southwest and south, and the Black Hills Uplift to the east. Along the western side of the basin, the strata have steep dips, averaging between 20 and 25 degrees. Along the eastern side of the basin, the dips are much shallower, ranging from 2 to 5 degrees (Ellis et al. 1998). Outcrops within the Powder River Basin consist primarily of Tertiary rocks from the Paleocene Fort Union and Eocene Wasatch formations (Fig 3-10). However, within the Powder River Basin portion of the planning area, rocks of the Fort Union formation are more numerous. The Fort Union formation is divided into three members (in descending order), the Tongue River, Lebo, and Tullock members. The formation consists of interbedded sandstones, siltstones, mudstones, carbonaceous shale, and coals. Numerous coal beds occur in the Fort Union formation and are of sub-bituminous rank. The Tongue River member contains the most important, minable coal beds in the Fort Union formation (Sholes and Daniel 1992). The coal beds are more laterally extensive and thicker within this interval. These coal beds are being mined and are the source of the CBNG near the western boundary of the planning area. The Tongue River member varies in thickness between 750 feet near the outcrop, to over 3,000 feet near the axis of the Powder River Basin (Roberts et al. 1999a; Roberts et al. 1999b). One of the coal beds mined in the southern portion of Big Horn County was over 80 feet in thickness. In addition to the Tertiary rocks, deeper Cretaceous strata, including the Judith River formation, Eagle and Muddy sandstones, and the Dakota and Lakota formations, are overlain by Bearpaw shale and are present across the Powder River Basin at depths ranging from 2,000 to 9,000 feet (Noble et al. 1982).

Cretaceous rocks also outcrop in the planning area. This occurs primarily along the Missouri River, in the areas of the Poplar and Porcupine domes, along the Cedar Creek Anticline, and in the southeast portion of the planning area where the Black Hills Uplift has influenced the strata. The oldest Cretaceous unit that outcrops in the planning area is the Mowry formation, which occurs in the extreme southeast portion of the planning area.

WILLISTON BASIN

The Williston Basin is the other important geologic structural feature in the planning area. The Williston Basin is a nearly circular basin with the center located near Williston, North Dakota. The Williston Basin encompasses approximately 300,000 square miles extending into South Dakota and the Canadian provinces of Saskatchewan and Manitoba. At its deepest point, sediments are believed to be as much as 16,000 feet thick with the strata becoming shallower and thinner toward the margins. It is believed that initial basin subsidence occurred during the Late Cambrian to Early Ordovician periods. Two prominent structural features, the Cedar Creek Anticline and the Poplar Dome, occur in the Montana portion of the Williston Basin (Heck, LeFever, Fischer, and LeFever 2002).

The sedimentary rocks within the Williston Basin are unique because the basin contains one of the most complete rock records observed, with sedimentary rocks from the Cambrian through the Holocene periods

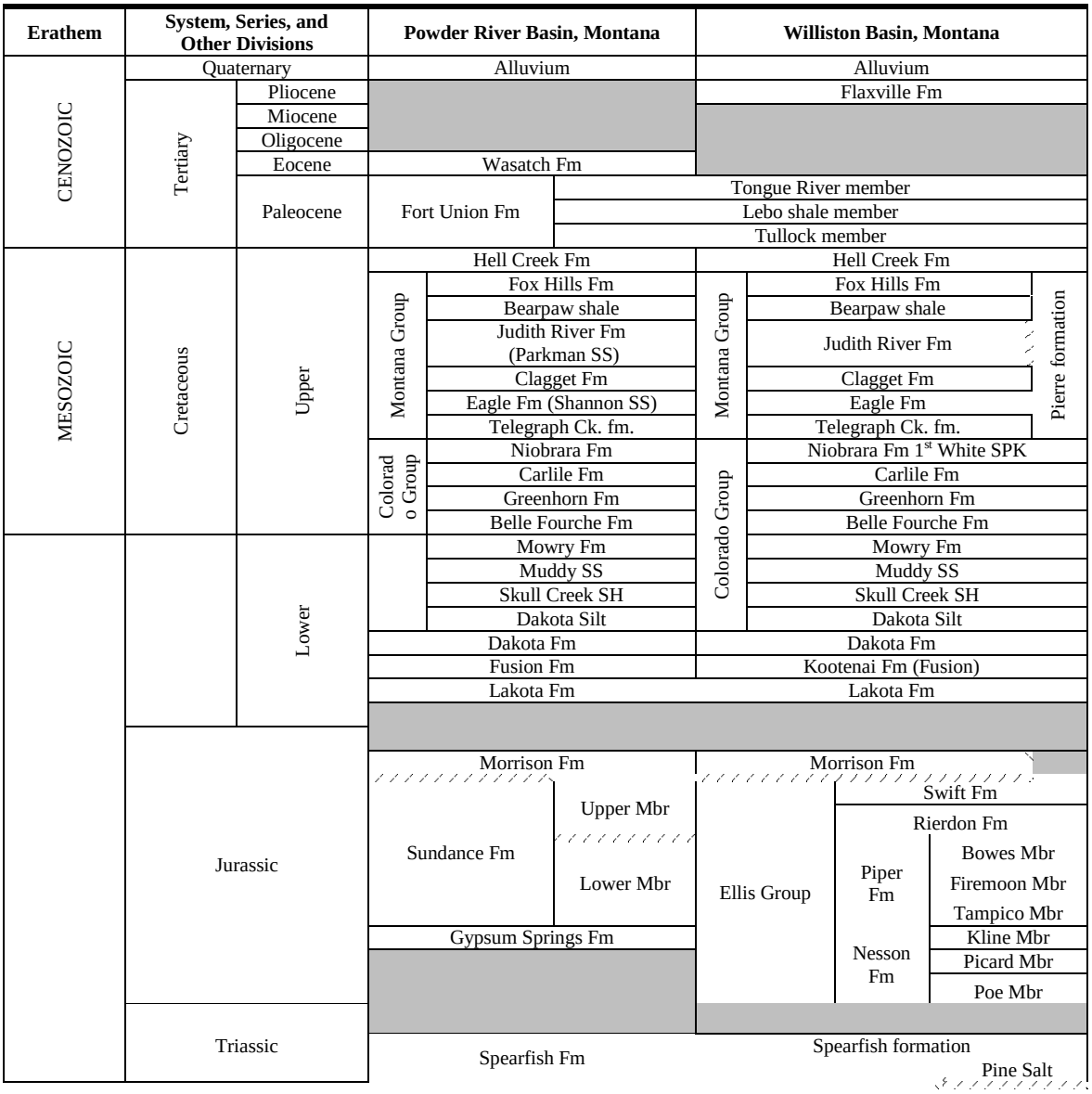
(Schmoker 1996; Heck et al. 2002). Outcrops within the planning area of the Williston Basin consist primarily of Tertiary sediments from the Fort Union formation. This formation consists of sandstones, siltstones, mudstones, limestones, carbonaceous shale, and coals (Flores 1992). Sandstone is the most common rock type and limestone is the least common. The coal beds are mainly lignite in rank. Within the planning area, the Fort Union formation contains economic coals that are laterally extensive. Although CBNG has not been produced from coals within the Williston Basin, a small surface mining operation is located in the eastern portion of the planning area.

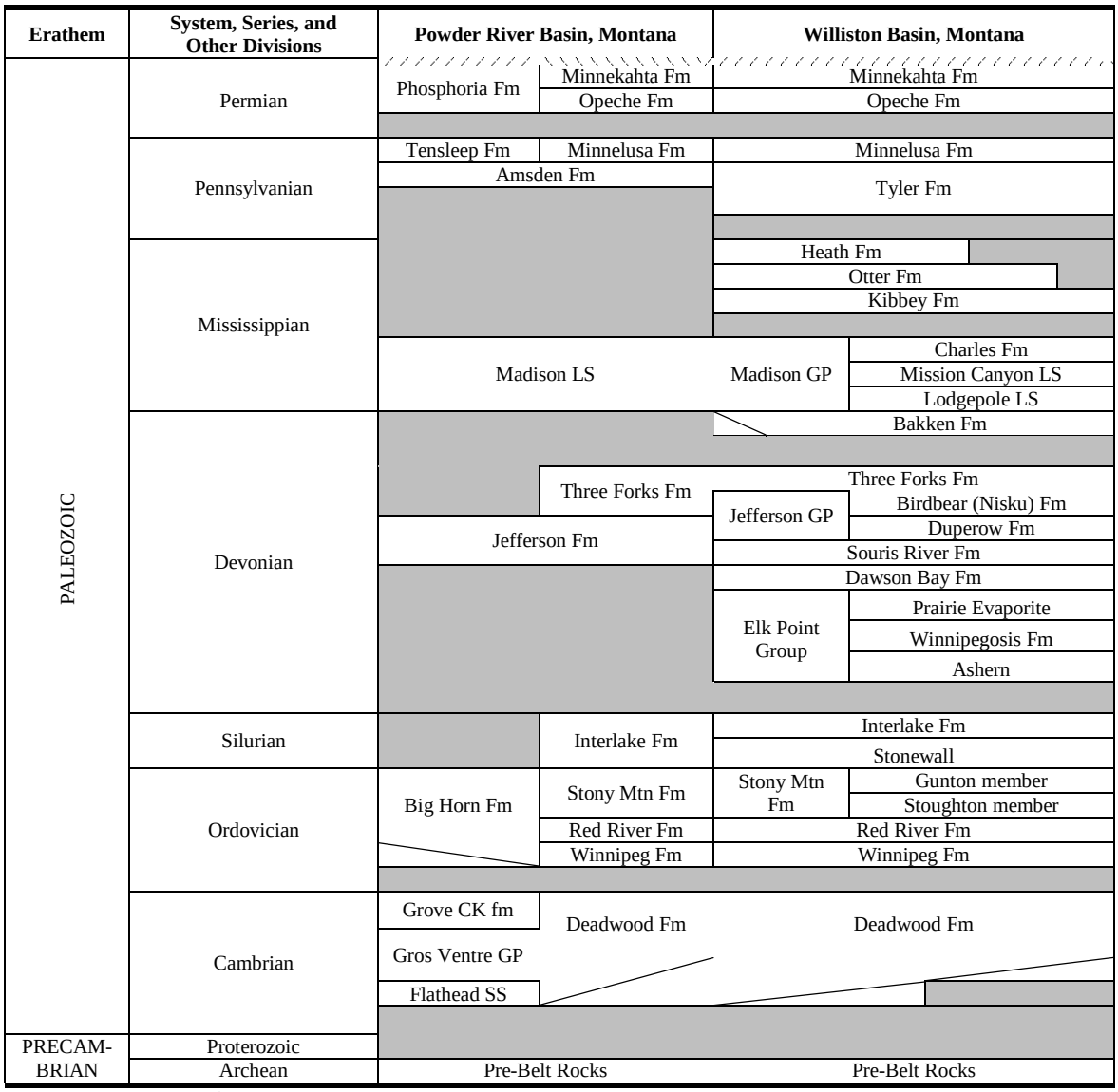
GEOLOGIC HAZARDS

Geologic hazards within eastern Montana consist primarily of threats from earthquakes but even these events are rare. Most strong earthquakes in Montana have occurred in the western third of the state. The only significant earthquake outside this area was a magnitude 6 event that occurred on June 24, 1943, within the planning area, in the southern portion of Sheridan County. A well-constructed granary located at Froid, Montana, was so severely damaged that wheat spilled out, and cracked plaster and minor chimney damage were reported at the towns of Homestead, Redstone, and Reserve, Montana (USGS 1974).

As described in the *Geologic Resources* section, minerals of commercial value occur throughout the planning area. Private entities, state governments, or the federal government own or administer mineral ownership (Map 27). The following discussion relates to leasable minerals (coal, oil and gas, phosphate, asphalt, sulfur, potassium, and sodium), locatable minerals (gold, silver, bentonite, uranium, and other metals), and mineral materials (sand, gravel, building stone, pumice, and clay) administered by the federal government.

FIGURE 3-10. STRATIGRAPHIC COLUMN OF THE PLANNING AREA PORTIONS OF THE POWDER RIVER AND WILLISTON BASINS





Source: Montana Board of Oil and Gas

LEASABLE MINERALS

COAL

There are approximately 10,924,000 BLM-administered coal acres in the planning area (see Map 29). Currently, five surface mines (Absaloka, Decker, Rosebud, Savage, and Spring Creek) produce coal in the planning area (Maps 33 and 35 through 39). The total permitted area for these mines is about 70,274 acres. Of this total, about 39,272 acres have been disturbed and about 19,923 acres have been reclaimed through the seeding stage (OSM, Draft Annual Oversight Report, 2013). The inactive Big Sky Mine is also located in this area and is fully reclaimed. Four of the mines (Absaloka, Decker, Rosebud, and Spring Creek) mine coal beds within the Tongue River member of the Fort Union formation and are located in the Montana portion of the Powder River Basin. This area contains large coal deposits, much of which is administered by the federal government. The coal is sub-bituminous in rank. Most of the coal mined in the planning area is shipped out of state and the remainder of the coal is burned at mine-mouth located power plants. A small amount of coal is trucked in state to power plants and manufacturing facilities.

The Absaloka Mine, located in Big Horn County, operates entirely on Indian coal leases. The coal is owned by

the United States in trust for the Crow Indian Tribe. The BLM does not administer the coal leases but does provide review and approval authority for certain aspects of the mine plan and inspection for production verification to ensure maximum economic recovery of coal for the benefit of the Crow Tribe. The coal screening process and BLM planning efforts do not apply to Indian trust coal lands.

The Savage Mine is a small surface operation located near Sidney, Montana, and is the only mine within the Montana portion of the Williston Basin. The coal (lignite in rank) is trucked to a local power plant and sugar beet processing facility.

In 2012, total production from the five mines located in the planning area was about 30.95 million tons (Montana DEQ, website for Historical energy Statistics, Energy Source Workbooks, Coal Tables Workbook – 2012 Update, Table C4. Coal Production by Company, 1980-2012. http://deq.mt.gov/Energy/HistoricalEnergy/default.mcpx).

A recent U.S. Geological Survey report determined that more than 162 billion short tons (BST) of available coal resources are within the Montana portion of the Powder River Basin and about 35 BST identified as recoverable by surface mining methods. Also that about 42 BST of underground coal resources are within the Montana portion of the Powder River Basin and that 80 percent (34 BXT) are within 500 to 1000 feet of the surface, (Hacke, J.E. et.al. 2012). Averett (1974) reported that there are about 120 billion short tons of demonstrated coal reserves in the state of Montana.

The Powder River RMP focused primarily on the management of federal coal resources. The principal factor considered for coal resource development during land use planning is the identification that states coal areas are acceptable for further consideration, which includes coal leasing as defined by 43 CFR 3420.1 4(e):

> "The major land use planning decision concerning the coal resource shall be the identification of areas acceptable for further consideration for leasing which shall be identified by the screening procedures listed below."

Four coal screens must be applied as described below.

- Identification of Coal with Development Potential: Areas could be eliminated from further consideration if they do not contain coal with development potential.
- Surface Owner Consultation: Negative surface owner views could cause lands to be eliminated from further consideration.
- Application of Unsuitability Criteria: Areas can be eliminated if determined to be unsuitable for surface mining based upon application of a list of 20 unsuitability criteria.
- Multiple Use Conflict Analysis: Additional areas of coal resource may be eliminated from consideration based on multiple use considerations if other federal resource values are determined to be superior to the coal resource.

Previous planning efforts identified 62.20 billion tons of coal available for further consideration for coal leasing (not including coal that was leased at the time) in the Powder River RMP area and 6.18 billion tons of coal were found acceptable for further consideration for leasing in the Big Dry Resource Area RMP. The total amount of coal considered available for further consideration for coal leasing in both RMPs combined is 68.38 billion tons. See Map 35 for coal areas considered acceptable for further consideration for leasing in the planning area. Any party desiring a coal lease can apply and the application would be considered based on its own merits. The coal planning process is described in the *Coal* section of the *Minerals Appendix*.

OIL AND GAS

INTRODUCTION

Since the early 20th century, oil and gas development has been underway in the planning area, which consists of approximately 5 million acres of BLM-administered oil and gas mineral estate. Current development is focused in two exploration and production areas, the Williston Basin (which includes the Cedar Creek Anticline, Poplar Dome, Williston Basin northeast, and all remaining areas within the basin) and the Powder River Basin. The Powder River Basin contains CBNG within the Lower Tertiary Fort Union Formation, while in the Cedar Creek Anticline and the northeastern Williston basin areas, oil and gas resources occur in various formations (from the Cambrian Deadwood through the Upper Cretaceous Eagle Formations). The northeast Williston Basin and Cedar Creek Anticline areas are two of the most active oil- and gas-producing regions in Montana and CBNG development has made the Powder River Basin one of the largest natural-gas-producing regions in Montana.

HISTORICAL DRILLING AND COMPLETION ACTIVITY

There have been 12,880 wells drilled in the planning area as of October 1, 2013. In 1914 a gas well was drilled in Dawson County (Gas City Field), and two more gas wells were drilled in Dawson County in 1915. In 1916 gas wells were drilled in Dawson and Fallon counties (Gas City and Cedar Creek fields). By the late 1920s, every county in the field office area except Treasure and McCone had a well drilled within their boundaries. A well was drilled in Treasure County in 1947 and in McCone County in 1952. Since then, drilling activity (exploratory and development) has occurred in most of the counties in the planning area.

In the last 12 years (wells spud January 1, 2000, through December 31, 2012) 3,645 wells have been drilled within the planning area (MBOGC, 2013). Approximately 73 percent of the wells drilled and completed over the last 12 years are currently producing. Unsuccessful wells were completed as “abandoned” as reported by the MBOGC (2013). This success rate is quite high and is attributable to the fact that most of these wells were drilled within field boundaries and most would be considered to be infill wells. About 35 percent of these wells were drilled along the Cedar Creek Anticline, with most wells targeting the Red River and Eagle Formations. Another 37 percent were drilled in Richland County, targeting the Bakken Formation. About 30 percent of the wells have been drilled in Big Horn, Rosebud, and Powder River counties to target the coal beds of the Fort Union Formation.

Only 238 of the wells spud January 1, 2000, through December 31, 2012 are classified as wildcat wells drilled outside field boundaries (MBOGC, 2013). Only about 38 percent of the above wildcat wells drilled and completed over the last 12 years were successful. Unsuccessful wells were completed as “abandoned” as reported by the MBOGC (2013). Historically, industry has considered a 10-percent success rate for wildcat wells to be the industry average.

Table 3-28 shows the wells drilled within the MCFO planning area drilled between 2000 and 2012. The majority of the wells have been drilled in Big Horn, Richland, and Fallon Counties. In Big Horn County the majority of the wells were CBNG wells, the majority of the wells in Richland County were horizontal Bakken Formation wells, and the wells in Fallon County were predominately a mix of Eagle Formation gas wells and horizontal Red River Formation wells.

TABLE 3-28.
OIL AND GAS WELLS DRILLED IN THE PLANNING AREA BY COUNTY IN THE LAST 12 YEARS

County	Year													
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Big Horn	77	41	22	188	43	163	325	70	72	19	5	0	19	**1,044**
Carter	3	1	2	4	6	1	0	1	3	0	0	0	1	**22**
Custer	1	3	3	1	0	0	0	0	0	0	0	0	0	**8**
Daniels	0	1	2	1	1	0	0	0	0	1	0	0	6	**12**
Dawson	0	0	9	3	7	9	4	0	0	4	2	1	1	**40**
Fallon	73	105	80	120	133	138	98	120	87	22	67	0	1	**1,044**
Garfield	2	0	0	0	0	0	0	3	0	0	1	0	0	**6**
McCone	0	0	2	1	0	1	3	1	0	0	0	1	0	**9**
Powder River	2	19	4	0	4	4	1	0	0	0	0	1	14	**49**
Prairie	0	1	3	1	0	1	0	0	0	0	0	0	0	**6**
Richland	6	24	22	47	98	144	161	123	71	14	42	30	141	**923**
Roosevelt	11	6	6	7	7	4	12	11	9	2	9	14	54	**152**
Rosebud	4	5	14	10	4	1	2	4	6	3	2	3	6	**64**
Sheridan	6	13	5	7	6	17	6	16	8	3	10	10	29	**136**
Valley	1	10	6	5	2	3	8	2	7	21	15	2	3	**85**
Wibaux	8	7	0	4	2	3	15	1	0	0	0	0	5	**45**
Total	**194**	**236**	**180**	**399**	**313**	**489**	**635**	**352**	**263**	**89**	**153**	**62**	**280**	**3,645**

Source: MBOGC http://www.bogc.dnrc.mt.gov/WebApps/DataMiner/Wells/WellPermits.aspx, accessed September 23, 2013

Historical Production

The U.S. Department of Energy, Energy Information Administration (2011) indicated that Montana's crude oil production for 2010 amounted to about 1.3 percent of total United States production. Gas production in 2009 amounted to about 0.5 percent of total United States production (DOE-EIA, 2011).

Data from the MBOGC (2011b) was used to compile cumulative production by county (data from 1996 through August 31, 2011) (Table 3-22). As of August 31, 2011, more than 329,200,000 barrels of oil and more than 558,400,000 thousand cubic feet of natural gas and associated gas had been produced (Table 3-29).

TABLE 3-29.
CUMULATIVE OIL AND GAS PRODUCTION BY COUNTY

County	Oil (barrels)	Natural Gas (thousand cubic feet)	Associated Gas (thousand cubic feet)
Big Horn	1,050,078	119,116,699	0
Carter	192,352	338,609	0
Custer	0	2,303,953	0
Daniels	216,200	0	17,600
Dawson	6,777,769	0	2,905,598
Fallon	98,662,000	201,770,583	49,921,329
Garfield	294,414	0	28,324
McCone	217,228	0	0
Powder River	3,812,793	1,862,211	246,182
Prairie	1,394,249	16,018	158,488
Richland	149,027,629	253	123,353,349
Roosevelt	22,732,355	0	12,386,981
Rosebud	5,513,933	0	301,748
Sheridan	25,757,421	0	14,289,801
Valley	2,358,969	19,029,762	542,147
Wibaux	11,256,085	6,697,167	3,114,677
Total	**329,263,475**	**351,135,255**	**207,266,224**

Existing Leases

Two oil and gas lease sales are held at the Montana State Office (MSO) each year involving tracts under the jurisdiction of the MCFO. As of May 17, 2010, the BLM's leasing process is conducted in accordance with WO IM No. 2010-117. The leasing process established in this IM provides for consideration and protection of natural and cultural resources and other land uses as well as meaningful public involvement. See the *Fluid Minerals Operations and Procedures in the Minerals Appendix* for more details on the leasing process and public involvement.

As of February 20, 2014, there are a total of 1,492 authorized federal leases in the planning area covering 887,305 acres, approximately 3.4 percent of the field office. Of those acres approximately 46 percent are on BLM surface, 53 percent are on private surface, and 1 percent are administered by other Surface Management Agencies. Table 3-30 shows MCFO sale results for the last eight years.

Interest in the Middle member of the Bakken Formation by industry continues to grow. Oil and gas lease sales held by the state (Richland, Roosevelt, and Sheridan counties) have increased from an average of $25.81 per acre in March 2005, to $247.67 per acre in March 2010 (MDNRC, 2011). BLM lease sales of oil and gas minerals show similar trends.

TABLE 3-30.
OIL AND GAS LEASE SALES FOR THE
MILES CITY FIELD OFFICE (2005 TO 2012)

Sale Date (Calendar Year)	Parcels Offered	Parcels Sold	Acres Offered	Acres Sold	Total Bonus	Average Bonus per Acre
2005	183	66	124,994	39,464	$556,306.75	$14.10
2006	107	74	96,671	68,975	$761,115.50	$11.03
2007	339	149	521,153	159,742	$977,897.00	$6.12
2008	36	25	12,383	12,383	$707,759.50	$57.16
2009	60	59	38,297	37,537	$786,366.75	$20.95
2010	127	107	95,657	73,658	$4,531,092.71	$54.43
2011	113	113	50,973	50,973	$5,934,005.46	$219.16
2012	277	277	99,138	99,138	$13,508,564.75	$174.07
Total	**1,242**	**870**	**1,039,266**	**541,870**	**$27,763,108.42**	**$557.02**
Average Annual	**155.25**	**108.75**	**129,908.25**	**67,733.75**	**$3,470,388.55**	**$69.63**

Source: BLM LR2000 Report, September 2013

Units, Fields, Communitization Agreements

Development within the planning area can take place within a federal unit, communitization agreement, field, or as exploratory wells. A federal unit agreement or plan for the development and operation for the recovery of oil or gas from unit lands as a single consolidated entity without regard to separate ownerships and for the allocation of costs and benefits on a basis as defined in a the agreement or plan (43 CFR 3186.1). Federal units are intended to facilitate the orderly and timely exploration, development and operation of multiple leases by a single operator. As of the date of this document, federal oil and gas leases are incorporated into 32 unit agreement areas that lie wholly or partly within the planning area. These units encompass lands totaling approximately 396,536 acres in area, or 0.02 percent of the total lands in the planning area. New units in the planning area could be established at any time in the future in response to evolving geological interpretations, improvements in exploration, drilling, and production technologies, or other factors.

Communitization agreements may be authorized when a federal or Indian Trust lease cannot be independently developed and operated in conformity with an established well-spacing or well-development program. As of the date of this document, there are 324 active communitization agreements within the planning area, encompassing approximately 137,634 acres.

There are 225 designated oil and gas fields in the planning area. They range in size from the 95,000-acre Cedar Creek field to numerous small fields of 160 to 640 acres. The fields are designated by the MBOGC, which names the fields and establishes the spacing and other rules for the fields (MCA 36.22.702).

Current Drilling and Completion Operations

To ensure that drilling and completion operations are conducted in a safe and environmentally sound manner, the BLM approves and regulates all drilling and completion operations, and related surface disturbance associated with Federal and Indian oil and gas mineral development. Operators must submit APDs to the agency in accordance to Onshore Oil and Gas Order No.1. Prior to approving an APD, the BLM identifies all potential subsurface formations that will be penetrated by the wellbore.

This includes groundwater aquifers and any zones that would present potential safety or health risks that may need special protection measures during drilling, or that may require specific protective well construction measures. All well casing and cementing operations that occur on Federal/Indian lands would be reviewed and approved by BLM and conducted in accordance with the applicable requirements specified in Onshore Oil and Gas Order No. 2 and the American Petroleum Institute (API) standards.

The majority of oil and gas wells in the planning area have traditionally been drilled vertically. Of the 12,880 wells drilled (this number does not include permitted wells or permitted injection wells) in the planning area, 10,963 were vertical wells and 1,917 were drilled as horizontal wells or horizontal re-drills. In the 11-year period from January 2000 to January 2011, a total of 5,150 vertical, 167 directional, and 1,028 horizontal wellbores were drilled in Montana (MBOGC, 2013). Of those, 2,178 vertical, 26 directional, and 1,001 horizontal wellbores were drilled in the planning area during the 11-year period. Of the current producing wells in the planning area, 1,864 were vertical wells, 21 were drilled as directional wells, and 1,336 were drilled as horizontal wells or horizontal re-drills for a total of (MBOGC, 2013).

Vertical Drilling

The vertical wells producing in the planning area are completed in a variety of formations for both gas and oil. The most productive horizon completions have been those of the Red River, Eagle, Bakken, and Muddy Formations. Vertical well depths in Montana range from a few hundred feet in the south-central portion of the planning area to over 13,000 feet in the Williston Basin in Richland County. As of September 1, 2013, the deepest producing vertical well is the Bakken Larson 24-2, which was drilled in 1979 to a depth of 13,400 feet and is currently producing from the Duperow Formation.

Directional and Horizontal Drilling

Directional drilling may be used where the drill site cannot be located directly over the drilling target. There are limits to both the degree that the wellbore can be deviated from the vertical and the horizontal distance the well can be drilled away from the well site. See *Drilling Access with NSO Stipulations on Oil Leases* in the *Fluid Minerals Appendix* for additional information. Gas wells in the planning area are typically not deviated for technical and economic reasons.

Benefits of directional drilling include the avoidance of sensitive or inaccessible surface features (resulting in greater protection of sensitive environments), and, when multiple wells are drilled from the same vertical wellbore or from the same surface location, a reduction in drilling time and associated waste volumes and emissions.

Recent technological advances in horizontal drilling and hydraulic fracturing, described below, have allowed development of unconventional zones (methane-bearing coal zones, oil or gas bearing shale zones, gas hydrates or “tight gas” in low porosity or low permeability traditional zones), that were once universally considered as uneconomic.

Horizontal drilling is commonly considered being at least 80 degrees from the vertical so that the borehole penetrates a productive formation in a manner parallel to the formation. Most horizontal wells are drilled vertically from the surface to several hundred feet above the productive formation. The wellbore is then drilled in a curve ending with well going sideways through the productive formation.

The majority of the currently producing horizontal wells in the planning area are producing oil from the Red River Formation and the Upper Devonian-Lower Mississippian Bakken Formation, a horizontal play in North Dakota, Montana, and Saskatchewan that recently has been the focus of drilling in the area.

Benefit of horizontal drilling also include avoidance of sensitive or inaccessible surface features (resulting in greater protection of sensitive environments), multiple wells drilled from the same well pad, and wellbore exposure to a far greater surface area of hydrocarbon-bearing rock when compared to a typical vertical well. Horizontal wells tend to produce more than vertical wells since there is more reservoir rock exposed. This technology also eliminates the need to drill as many wells, since a horizontal well would be capable of producing the oil and gas from a larger areal extent. While this technology may reduce the overall foot print of an oil or gas field, as a result of having multiple wells (multi-well pad), and possibly production facilities on one well pad, the pad is typically larger in size for drilling and production operations. This reduces the acres of surface disturbance per well. See section below *Multiple Wells On A Single Well Pad* below for further details on multi-well pads.

Drilling time may be longer for horizontal wells than for a vertical well drilled to the same producing formation due to increased drilling footages; however, technology and increased experience of the area is decreasing drill time for horizontal wells. The need for more drilling mud volume may also increase water needs, pit size or number of holding tanks on site compared to a vertical well to the same producing formation.

Drilling and completion costs for directional and horizontal wells are typically significantly higher than for conventional vertical boreholes, even when the cost savings associated with reduced need for surface disturbance is considered. As a result of these increased costs and risk, operators tend to prefer vertical over directional or horizontal boreholes unless special circumstances exist that make such drilling a necessity or economically attractive. In addition to increased costs, the risk of losing the well because of geologic or mechanical failures is also greater in directional and, particularly, horizontal boreholes than in conventional vertical boreholes.

Well Completion and Stimulation

After the well is drilled, if necessary, testing operations would commence. If testing indicates the presence of an economic level of oil and/or gas, the well would be completed for production. Typical completion operations would involve setting and cementing the production casing to the total depth of the well. There are also instances where casing is set at the top of the target zone, and the formation is completed in the open hole.

After the proper casings are set, wells are often treated to improve the recovery of hydrocarbons by increasing the rate and volume of hydrocarbons moving from the natural oil and gas reservoir into the wellbore. In many instances, the well(s) would not give up commercial volumes of oil or gas unless they were stimulated. These processes are known as well-stimulation treatments, and they are designed to create new fluid passageways in the producing formation or remove blockages within existing passageways. They include fracturing, acidizing, and other mechanical and chemical treatments often used in combination. The results from the different treatments are additive and often complement each other, which makes it possible to introduce fluids carrying sand, or other small particles of material into the newly created crevices to keep the fractures open when the pressure is relieved. This increases the flow rate and volume of reservoir fluids that move from the producing formation into the wellbore.

Water produced during drilling, hydraulic fracturing, and completion operations is contained in a lined pit or in steel tanks on location. The water can be disposed of by trucking it to an authorized disposal pit, allowing the water in the lined pit to evaporate within required timeframes, through subsurface injection, or treated and reused to drill or complete another well. The disposal of water generated during drilling and completion operations in an injection or disposal well requires permit(s) from the primacy state or USEPA. See the *Fluid Minerals Operations and Procedures Produced Water* section for details on primacy. A NEPA analysis is prepared for all requests concerning disposal of water generated from federal wells and in accordance to federal and state regulations.

After completion operations are finished, wellhead equipment consisting of various valves and pressure regulators are installed to control the oil or gas flow to the production facilities and allow safely shutting in the well under any conditions.

Hydraulic Fracturing

Hydraulic fracturing has been utilized by the oil and gas industry since the late 1940s. Within the planning area, hydraulic fracturing, in conjunction with horizontal drilling described above, has allowed for development of unconventional zones that were once considered uneconomical, like the Bakken and Three Forks Formations in the Williston Basin area.

Hydraulic fracturing is a technique used to create additional space and connecting existing fractures and existing rock pores with newly created fractures that are located in deep underground geologic formations. The induced space allows the rock to more readily release oil and natural gas so it can flow to the surface via the well bore that would otherwise be uneconomical to develop. Wells that undergo hydraulic fracturing may be

drilled vertically, horizontally, or directionally and the resultant fractures induced by the hydraulic fracturing can be vertical, horizontal, or both. The typical steps of hydraulic fracturing can be described as follows:

1. Water, sand and additives are pumped at high pressures down the wellbore.
2. The liquid goes through perforated sections of the wellbore and into the surrounding formation, fracturing the rock and injecting sand or other proppants into the cracks to hold them open.
3. Experts continuously monitor and gauge pressures along with the volume of fluids and proppants, while studying how the sand reacts when it hits the bottom of the wellbore; slowly increasing the density of sand to water as the frac progresses.
4. This process may be repeated multiple times, in "stages" to reach maximum areas of the wellbore. When this is done, the wellbore is temporarily plugged between each stage to maintain the highest water pressure possible and get maximum fracturing results in the rock.
5. Frac plugs are drilled or removed from the wellbore and the well is tested for results.
6. The water pressure is reduced and fluids are returned up the wellbore for disposal or treatment and re-use, leaving the sand in place to prop open the cracks and allow the oil/gas to flow to the well bore.

Fracturing fluid is typically more than 98 percent water and sand, with small amounts of readily available chemical additives used to carry the proppant and control the chemical and mechanical properties of the water and sand mixture. Proppant, consisting of synthetic or natural silica sand, may be used in quantities of few hundred tons for a vertical well to a few thousand tons for a horizontal well. The amount of water needed to fracture a well in the planning area depends on the geologic basin, the formation, and depth and type of well (vertical, horizontal, directional), and the proposed completion process. The amount of water used to hydraulic fracture a Bakken or Three Forks well is approximately 2-4 million gallons of water per well (USEPA, 2012).

Several sources of water are available for hydraulic fracturing in the planning area. The *Fluid Minerals Operations and Procedures (see Minerals Appendix)* contain further details on sources of water that could potentially be used for hydraulic fracturing or drilling operations. The use of any specific water source on a federally administered well, requires the proposal be reviewed and analyzed through the NEPA process for BLM approval during the APD stage to ensure compliance with Montana water laws and federal regulations.

Before hydraulic fracturing takes place, all surface casing and some deeper, intermediate zones are required to be cemented from the bottom of the cased hole to the surface in accordance to Onshore Oil and Gas Order No.2, MBOGC rules and regulations, and API standards. The cemented well is pressure tested to ensure there are no leaks and a cement bond log is run to ensure the cement has bonded to the casing and the formation.

MBOGC regulations also ensure that all resources including groundwater are protected. The MBOGC regulations require new and existing wells, which will be stimulated by hydraulic fracturing, must demonstrate suitable and safe mechanical configuration for the stimulation treatment proposed. If the operator proposes hydraulic fracturing through production casing or through intermediate casing, the casing must be tested to the maximum anticipated treating pressure. In accordance with MBOGC Rule 36.22.1015 operators are required to disclose and report the amount and type of fluids used in well stimulation to the Board or, if approved by the Board, to the Interstate Oil and Gas Compact Commission/Groundwater Protection Council hydraulic fracturing web site (FracFocus.org).

Multiple Wells from a Single Well Pad

Polling of active operators in North Dakota conducted in May 2010, indicated areas of activity in which development is expected to occur with an average of 1.5 wells per well pad. The areas are locations in which either the Bakken or Three Forks Formations new exploratory oil well development is expected to include some multi-well pads (Smart well pad) for drilling to either Three Forks or Bakken Formation oil, as well as areas in which existing or new Bakken Formation wells will be co-located with Three Forks Formation wells. It is important to note that 1.5 wells per pad is the anticipated average and that some well pads may have far more than the average (as many as eight according to one operator's estimate); however, it is still dependent on the need to properly develop the formations, but many more will be single-well pads.

A multi-well pad is typically larger in size for drilling and production operations as a result of having multiple wells and possibly production facilities on one well pad. Because the same well pad, pipeline corridor, access road, and production facilities are being used for multiple wells, it reduces the surface disturbance per well. Multi-well pad development is a Best Management Practice (BMP) being applied in the planning area on a case-by-case basis to co-locate and reduce surface disturbance for oil wells in areas of Bakken or Three Forks Formations development and CBNG development areas using monobore drilling techniques.

Current Development

As of November 1, 2013, the MBOGC reports 6,024 total active wells in the planning area, of which 3,335 are producing wells, 1,472 are shut in wells, 655 are active injection wells, 299 are temporarily abandoned wells, and 253 are in drilling status or are permitted to be drilled in the planning area. Seventy-four percent, or 4,463, of these wells are located within the Williston Basin Province; this includes the Cedar Creek Anticline. The Powder River Basin contains 1,312 active wells.

Of the 6,024 total number of wells, the MCFO has a total of 1,767 federally administered wells, of which 1,319 are active wells, 9 are in drilling status, and 439 have been plugged and abandoned within the planning area. Table 3-31 shows the wells by county.

TABLE 3-31.
MCFO FEDERAL WELL STATUS BY COUNTY

	Active	Plugged	Drilling Status	Totals
BIG HORN	175	8	0	**183**
CARTER	30	13	0	**43**
CUSTER	1	2	0	**3**
DANIELS	0	5	0	**5**
DAWSON	49	36	0	**85**
FALLON	717	166	1	**884**
GARFIELD	8	21	0	**29**
MCCONE	0	8	0	**8**
POWDER RIVER	126	76	2	**204**
PRAIRIE	19	20	0	**39**
RICHLAND	73	20	5	**98**
ROOSEVELT	7	1	0	**8**
ROSEBUD	15	12	0	**27**
SHERIDAN	8	4	0	**12**
WIBAUX	91	47	1	**139**
VALLEY	0	0	0	**0**
Totals	**1,319**	**439**	**9**	**1,767**

Source: BLM AFMSS Report, September 2013

Conventional Oil and Gas

As of November 1, 2013, there are 6,024 active wells, of which 3,140 are active oil wells and 1,105 are active gas wells in the planning area. The largest operators (by number of active wells) in the planning area is Fidelity Exploration & Production Company (1,600 wells), Denbury Onshore, LLC (1,525 wells), Continental Resources, Inc. (246 wells), Enerplus Resources Corporation (205 wells), and TAQA North USA, Inc. (201 wells) (MBOGC 2013). Wells producing in the planning area are completed in a variety of formations for both gas and oil. To date, the most productive horizons completions have been those of the Eagle (1,100 feet to 2,100 feet deep), Muddy (4,400 to 4,900 feet deep), Red River (8,000 feet to 10,000 feet), and Bakken (9,000 feet to 10,500 feet deep) Formations.

Within the planning area, gas production associated with oil exploration and development activities is processed in accordance to Notice to Lessees and Operators of Onshore Federal and Indian Oil and Gas Leases (NTL-4A). As of June 1, 2014 there are 57 authorized federally approved flaring permits.

As oil wells deplete, operators will seek additional methods to produce more oil from producing formations to increase recoverable reserves. Enhanced oil recovery using CO_2 has been pursued by industry. In 2012, Denbury Resources Inc. (Denbury) initiated their CO_2 enhanced oil recovery in their Bell Creek Field. The project required installing the Greencore Pipeline from the Lost Cabin Gas Plant in Central Wyoming to carry CO_2 to wells in the Bell Creek Field in southeastern Montana. Denbury is implementing a commonly used method of enhanced oil recovery at Bell Creek that involves alternating injection of CO_2 and water into the reservoir by use of injection wells in a method called water-alternating-gas. This method helps to push the oil bank to production wells where the fluids are recovered. Denbury limited surface disturbance for Phases 1, 2, and 3 of the project by using 141 existing wells and only drilling 6 new wells. Preliminary field data is still being collected and analyzed to evaluate the Bell Creek Field CO_2 enhanced oil recovery project. Denbury would like to pursue a similar project in the Cedar Creek Anticline, however, no plans have been submitted.

Coal Bed Natural Gas

As of November 1, 2013, there is no CBNG production in the Williston Basin area nor are there any exploration activities in the planning area. The Tertiary coals and lignites in the Fort Union Formation have been pursued in only a very few wells across the Williston Basin, mostly in North Dakota. The coals rank from lignite to subbituminous and can be as thick as 105 feet. The coal beds targeted for CBNG production occur at a depth of approximately 750 feet. Three operators have drilled 12 CBNG tests in the Williston Basin in North Dakota. Several wells have had shows of CBNG but no production has occurred. Williston Basin CBNG development is still in the assessment stage with activity over the next 20 years expected to include only limited drilling for testing purposes.

Exploration and development of federal CBNG in the Powder River Basin is conducted in accordance to the BLM 2008 *Final Supplement to the Montana Statewide Oil and Gas Environmental Impact Statement and Proposed Amendment of the Powder River and Billings Resource Management Plans* (FSEIS). The level of CBNG development in the Montana portion of the Powder River Basin since the FSEIS, increased in the CX Field from 258 wells on March 30, 2003, to 1,111 wells in November 30, 2011. Current drilling practice for CBNG is to drill mono-bore wells, which reduces the number of wells from four to one per location. As of November 1, 2013, the MBOGC reports 838 active CBNG wells in the Powder River Basin, of which 290 are producing, 541 are shut-in, and 7 are temporarily abandoned. Development of CBNG in Montana has been slowed by the market price of gas and changes in the methods allowed for handling of produced water.

Geophysical Operations

Oil and gas geophysical exploration activities include data acquisition by use of ground vehicle or aircraft. Data are acquired to determine structures that may contain oil or gas. Geophysical exploration does not include core drilling for subsurface geologic information or well drilling for oil and gas. A federal oil and gas lease is not required before conducting geophysical operations. Information from geophysical exploration can assist in the selection of drill sites on existing leases or lead oil companies or others to request lands be offered for lease.

Geophysical operations on public lands are reviewed by the BLM. Exploration on public lands requires review and approval following the procedures in 43 CFR 3150, 3151, and 3154. Additional guidance is found in BLM Manual Section 3150 and Handbook 3150.

The office receives an average of four notices of intent to conduct oil and gas geophysical exploration operations (BLM Form 3150-4). Geophysical operator and field manager responsibilities during geophysical operations are described in the *Fluid Minerals Operations and Procedures in the Minerals Appendix*.

Geothermal

Geothermal energy is heat energy contained in the rocks of the earth's crust. Certain geologic conditions and processes resulted in shallow geothermal resources that underlie substantial portions of many western states, including land administered by the MCFO. As of 2013, there was a low level of interest in developing federally owned geothermal resources in Montana. See the *Fluid Minerals Operations and Procedures in the Minerals Appendix* for leasing and development.

These shallow resources can be classified as low temperature (less than 194° F), moderate temperature (194° F to 302° F), and high temperature (greater than 302° F). Low and moderate temperature resources are generally used for heating, rather than power generation. Binary steam plants can generate power with fluid temperatures between 225° and 360° F.

There is limited geothermal energy potential within the planning area because it is far removed from active volcanic or tectonic activity. Within the planning area, known resources, discovered during the course of oil and gas exploration, are limited to warm and hot water occurring in Paleozoic carbonates and warm water occurring in Cretaceous sandstones. One documented use of geothermal energy has occurred southeast of Ashland, Montana, where several "dry" oil and gas wells were converted to provide warm water for livestock (Sonderegger and Bergantino 1981). The BLM has received only a few inquiries since 1979 regarding the development of federal geothermal resources in Montana (BLM, 2004f).

Proposed Carter Master Leasing Plan

The Master Leasing Plan (MLP) concept, introduced in May 2010 via the Washington Office's Oil and Gas Leasing Reform Instruction Memorandum (IM) 2010-117, promotes a proactive approach to planning for oil and gas development. To determine whether or not circumstances warrant additional planning and analysis, WO-IM-2010-117 lists numerous criteria to be considered. Specifically, the BLM must prepare an MLP when all four of the following criteria are met:

- A substantial portion of the area to be analyzed in the MLP is not currently leased;
- There is a majority Federal mineral interest;
- The oil and gas industry has expressed a specific interest in leasing, and there is a moderate or high potential for oil and gas confirmed by the discovery of oil and gas in the general area;
- Additional analysis or information is needed to address likely resource or cumulative impacts if oil and gas development were to occur where there are:
    - Multiple-use or natural/cultural resource conflicts or
    - Impacts to air quality or
    - Impacts on the resources or values of any unit of the National Park System, national wildlife refuge, or National Forest wilderness areas, as determined after consultation or coordination with the NPS, the USFWS, or the USFS; or
      Impacts on other specially designated areas.

The BLM has the discretion to complete an MLP for areas that do not meet the MLP criteria. For example, even though a substantial portion of an area is already leased or an area lacks a majority Federal mineral interest, additional analysis of measures to resolve potential resource conflicts may benefit future leasing decisions.

MLPs expand the tools available to the BLM to address resource conflicts prior to leasing and present finer-scale analysis for identified smaller areas than the entire RMP planning area. It can help to control the amount and kind of surface uses based upon current condition and identified conflicts between resource values and leasing. The MLP process entails analyzing likely development scenarios and varying levels of protective design features and/or mitigation measures in a defined area with greater detail than a traditional RMP allocation analysis but at a less site-specific level than a development plan that has been fully defined by an operator.

The following are examples of the kinds of decisions that may be made as a result of preparation of an MLP:

- stipulations (No Surface Occupancy, Timing Limitation, and Controlled Surface Use);
- phased leasing;
- planned or required unitization of Federal lands;
- phased development;
- caps or limits on new surface disturbance (pending acceptable interim and final reclamation);
- use of existing infrastructure;
- multiple wells per pad;
- requirements to reduce or capture emissions;
- liquids gathering systems to centralized offsite production facilities;
- placement of all linear disturbances (e.g., pipelines and power lines) in corridors;
- extensive interim reclamation of roadway disturbance up to or including the road surface and reclamation of pads to the well head; and
- final reclamation fully restoring the landform and re-establishing the native plant community.

In accordance with WO IM 2010-117, an MLP area has been identified for a portion of Carter County (Map 3). The area is approximately 396,658 acres in size, containing 138,908 acres of BLM-administered surface; 233,250 acres of private land; and 24,500 acres of state land. Within the proposed MLP, there are approximately 283,162 acres of federal oil and gas minerals, of which, 440 acres have active valid existing leases. This area is within the Powder River Basin and contains high, medium, and low oil and gas development potential as determined by BLM (Table 3-32). Approximately 12 percent of the BLM-administered oil and gas minerals are considered to have high development potential, approximately 48 percent considered to have medium development potential, and 40 percent considered to have low development potential (Map 5) (see the Fluid Minerals RFD in the *Minerals Appendix*).

TABLE 3-32.
DEVELOPMENT POTENTIAL ACRES
WITHIN THE PROPOSED MASTER LEASING PLAN

Development Potential	MLP Area Acres and Percentage of Total	BLM-administered Surface Acres	BLM-administered Mineral Acres
High	57,545 (14%)	8,509	35,556 (12%)
Medium	140,343 (35%)	59,051	112,264 (40%)
Low	198,770 (51%)	71,349	135,342 (48%)
TOTAL	**396,658**	**138,908**	**283,162**

Resources found in the proposed MLP area include priority greater sage-grouse habitat (345,944 acres), greater sage-grouse leks (62 leks), raptor nests (50 nests), a great blue heron rookery, mule deer crucial winter range (64,008 acres), sensitive soils (61,066 acres), badlands/rock outcrops (37,690 acres) riparian/wetland areas (30,774 acres), waterbodies/streams (2,266 acres), Finger Buttes ACEC (1,521 acres), paleontological localities and cultural resource sites, and multiple major ROWs. Resource condition objectives and resource protection measures for each resource listed above can be found in Chapter 2, Table 2-1 of this document.

Reasonable Foreseeable Development

Within the planning area there is high, medium, and low oil and gas development potential (Table 3-33) as determined by BLM. Approximately 13 percent of the BLM-administered oil and gas minerals are considered to have high development potential, approximately 25 percent considered to have medium development potential, and 62 percent considered to have low development potential (Map 5) (see the Fluid Minerals RFD in the *Minerals Appendix*).

TABLE 3-33.
DEVELOPMENT POTENTIAL ACRES
WITHIN THE MILES CITY FIELD OFFICE

Development Potential	Planning Area Acres and Percentage of Total	BLM-administered Surface Acres	BLM-administered Mineral Acres
High	6,043,000 (23%)	263,422	747,679
Medium	6,655,000 (26%)	1,945,211	1,467,435
Low	13,120,000 (51%)	552,620	3,639,282
TOTAL	**25,818,000**	**2,761,253**	**5,854,396**

LOCATABLE MINERALS

Locatable minerals are those minerals for which a mining claim can be staked. There is very low potential for locatable minerals such as gold, chromium, titanium, zeolite, and associated minerals such as copper, lead, and zinc in the planning area and high potential for bentonite and uranium (see Map 30).

The Mining Law of 1872, as Amended (30 U.S.C. 22 et seq.) provides for the exploration, discovery, and mining of metallic and certain non-metallic minerals on federal lands. Any U.S. citizen or corporation organized under state laws can locate mining claims. A mining claim is located on federally administrated minerals that potentially contain deposits of locatable minerals.

Exploration and mining activity on most BLM-administered lands are subject to the regulations found in 43 CFR 3809. These regulations require that a notice be filed for all cases when an exploration proposal would disturb less than 5 acres. For exploration operations disturbing more than 5 acres of mining operations, a plan of operations is required. They further require the operator to prevent the unnecessary and undue degradation of the land, complete full reclamation of any disturbance, and provide a financial guaranty sufficient to cover 100 percent of the cost of reclamation. There is no requirement to file a notice for casual use activity.

Mining activities require the submittal of a plan of operations that includes a mining and reclamation plan as well as a description of all essential measures to prevent the unnecessary and undue degradation of the land. The BLM also requires a financial guaranty of 100 percent of the estimated cost to reclaim the disturbed area. The completion of a NEPA analysis that includes an opportunity for public comment on the mining proposal, is also required as part of the evaluation process.

BENTONITE

Bentonite clay is the predominate major locatable mineral in the planning area, occurring in the Cretaceous Belle Fourche and Mowry formations in the southeast corner of the planning area within the Powder River Basin. These deposits, located in southern Carter County near the town of Alzada, have been extensively mined by two companies. Bentonite also occurs in other Cretaceous rocks, such as the Hell Creek formation and Bearpaw shale. Bentonite is exposed along the Missouri River as far downstream as Brockton on the Fort Peck Indian Reservation, and along the axis of the Cedar Creek Anticline from Baker to Glendive.

Because limited exposures restrict the data available regarding the quantity and quantity of bentonite, an accurate determination of bentonite development potential in the planning area is difficult to make. However, since there are two active bentonite-mining operations in southern Carter County, future development of this resource in the planning area is anticipated to continue (Map 36).

URANIUM

Uranium mineralization has been documented in sandstones composing the Lower Cretaceous Fall River and Lakota formations in the planning area within southern Carter County. From the 1970s through the late 1980s,

mining and energy companies completed thousands of reconnaissance and closely spaced delineation drill holes.

Compilation and analysis of these data indicate the potential to expand existing mineralized areas. Meetings with state regulators have been conducted with the intention of permitting several of these projects for continued exploration and development. At this time, there are no uranium exploration or permitting operations being conducted in the planning area.

It is unknown if the uranium deposits that occur in the planning area will be developed but, if exploration efforts result in the identification of sufficient minable reserves and economics support development, it is possible that development of this resource may occur. Previous testing from the 1970s and 1980s indicates that conditions are favorable for in situ uranium recovery. This mining method would result in a smaller environmental footprint when compared to traditional mining methods (Map 37).

GOLD

In the 1930s, gold placer mining occurred in the Yellowstone River as far downstream as Miles City, but there is no record of the quantity produced. Because gold is rare and extremely fine-grained, gold mining is considered a recreational activity in the planning area.

MINERAL MATERIALS

Federal mineral materials consist of sand and gravel used for road surfacing and construction projects These mineral materials are dispensed in the best interest of the public while providing for reclamation of mined lands and preventing unnecessary degradation of non-mineral resources. Mineral materials occurring within the planning area (see Map 28) consist primarily of clinker, sand, and gravel (with small amounts of petrified wood, agate, and building stone). Mineral materials occurring on public land are reserved to the government and the land patented under the Stock Raising Homestead Act (30 U.S.C. 54 and 43 U.S.C. 299).

Because there are minimal gravel deposits and scoria in the planning area, clinker or scoria is commonly used in place of gravel for road-surfacing material. Clinker is reddish to black colored, heat-hardened rock formed by the burning of coal beds that thermally alter the overlying strata. Within the Fort Union formation, clinker covers approximately 1,500 square miles in the planning area and commonly caps ridges to form higher topographic landscapes. Approximately 50 to 90 billion cubic yards of clinker are present in the planning area. Coal mines located in the western portion of the planning area use clinker for surfacing haul roads and construction pads for structures and equipment.

Sand and gravel deposits occur in the major river valleys and cap terraces that are adjacent to and overlying some rivers. Sand and gravel terraces commonly occur approximately 300 feet above the Yellowstone River. Southwest of Forsyth, these deposits cap ridges up to 1,000 feet above the Yellowstone River. Smaller terrace deposits consisting of coarse quartz sand occur along Little Beaver Creek, north of Ekalaka. Several firms mine sand and gravel for road and construction projects in this area.

In the future, clinker, sand, and gravel will continue to be used for road surfacing and construction projects, while additional coal and CBNG development may increase the use of clinker. As long as the clinker remains within the boundary of the lease and is used for lease development, no charge is assessed for clinker removed in the process of extracting coal from under a federal lease. As mentioned above, mineral materials are reserved to the government on public lands and lands patented under the Stock Raising Homestead Act. Within the planning area, there are numerous active pits for mineral materials. The number and location of these pits are related by the number and location of ongoing construction projects. With the increase in oil and gas drilling in the planning area, the demand for scoria use in access road and drill pad construction has increased. Mineral materials may be obtained under a free use permit issued by federal, state, or local government agencies but the permit can only be sold to individuals or corporations. Limited amounts of petrified wood and agate may be collected for casual use without charge.

RECREATION

Recreation is a part of most lifestyles and an important element in overall quality of life. Lands within the planning area offer a diverse array of recreational activities and provide broad spectrum of recreational experience opportunities (Map 15). Recreational opportunities are available to the public on all BLM-administered lands with legal access. Some of the diverse array of recreational activities available within the planning area include hunting, wildlife viewing, driving for pleasure, fishing, picnicking, camping, hiking, OHV use, rock collecting, mountain biking, floating, horseback riding, photography, and snowmobiling. However, the most intensive, area-wide recreational use occurs during the big game hunting season.

RECREATION MANAGEMENT AREAS

The recreation management area is a land unit where Recreation and Visitor Services objectives are recognized as a primary resource management consideration and specific management is required to protect the recreation opportunities. The recreation management area designation is based on recreation demand and issues, recreation setting characteristics, resolving use/user conflicts, compatibility with other resource uses, and resource protection needs.

The recreation management area is designated as either a SMRA or an extensive recreation management area (ERMA). The BLM uses Recreation Setting Characteristics classifications to manage for a variety of recreation opportunities, including degree of development. All BLM-administered public lands are classified in one of three Recreation Management Area categories, as defined below.

- SRMAs are administrative units where the existing or proposed recreation opportunities and recreation setting characteristics are recognized for their unique value, importance or distinctiveness, particularly in comparison to other areas used for recreation. Management focus is to protect and enhance a targeted set of activities, experiences, benefits, and desired recreation setting characteristics. Recreation and Visitor Services management is recognized as the predominant land use planning focus, where specific recreation opportunities and recreation setting characteristics are managed and protected on a long-term basis.
- The ERMAs are administrative units that require specific management consideration in order to address recreation use, demand, or Recreation and Visitor Services program investments. Management focus for ERMAs is to support and sustain the principal recreation activities and the associated qualities and conditions of the ERMA. Management of ERMA areas is commensurate with the management of other resources and resource uses.
- Public Lands Not Designated as Recreation Management Areas are all lands not established as a SRMA or an ERMA. Management focus is to meet basic Recreation and Visitor Services and resource stewardship needs for these areas.

Special Recreation Management Areas

The three areas currently managed as SRMAs include the Powder River Depot, Calypso, and Lewis and Clark Trail. Summaries of current SRMAs in the planning area follow.

Powder River Depot SRMA

The Powder River Depot SRMA is located approximately 6 miles southwest of Terry, Montana, and contains approximately 162 acres and 2 miles of river frontage along the Yellowstone and Powder rivers. The SRMA includes a portion of the Lewis and Clark National Trail as well as views of Sheridan Butte and the Terry Badlands WSA. The area is also located within a portion of the Powder River Depot ACEC. The SRMA is used for dispersed recreation.

Calypso SRMA

The Calypso SRMA is approximately 71 acres and located next to the Terry Badlands WSA and along the Yellowstone River. The SRMA includes a portion of the Lewis and Clark National Trail and is a popular fishing, camping, picnicking, hiking, sightseeing, and wildlife-viewing area. Dispersed recreation occurs within this SRMA, including primitive camping opportunities.

Lewis and Clark Trail SRMA

The Lewis and Clark Trail SRMA is a corridor that encompasses a portion of the Missouri and Yellowstone rivers and totaling about 14,499 acres of BLM-administered land (Map 16). This SRMA includes the Lewis and Clark National Historic Trail, a developed recreation site, and dispersed use sites along the river shoreline. Primary recreation opportunities include fishing, camping, power boating, river floating, swimming, hiking, hunting, and wildlife viewing. See the *Special Designation Area* section for more information about the Lewis and Clark Trail. Due to better GIS mapping skills, the acreage of the SRMA boundary went from 16,350 acres to 14,499, which was a decrease of 1,851 acres. However, the original SRMA was never intended to be the entire 16,350 acres; the ROD listed the Lewis and Clark SRMA as 14,000 acres.

Other Areas

In areas in which recreation resources receive heavy use, developed recreation sites are often constructed or planned for to aid in managing impacts. Other areas of high interest to recreational users that are not currently SRMAs include Big Sky Back Country Byway, Dean S. Reservoir, Glendive Short Pine OHV Area, Hay Draw Travel Management Area (TMA), Knowlton TMA, Howrey Island, Matthews Recreation Area, Moorhead Recreation Area, Pumpkin Creek, and Strawberry Hill Recreation Area.

Proposed Special Recreation Management Areas

Proposed SRMAs include Dean S. Reservoir, Glendive Short Pine OHV Area, Howrey Island, Matthews Recreation Area, Moorhead Recreation Area, and Strawberry Hill, including two already designated SRMAs; Lewis and Clark and Calypso. The current Powder River Depot SRMA is within both the Lewis and Clark Trail SRMA and the Powder River Depot ACEC and lands would be managed according to those designations. Descriptions of proposed SRMAs are contained in the *Recreation Appendix*.

The remainder of the planning area is managed based on desired need and generally limited to custodial actions to prevent conflicts between resource uses and provide for the health and safety of the public and the health of the lands. Implementation decisions include categories such as management, administration, information, education and monitoring. Recreation management areas with complex implementation issues may require a subsequent plan that addresses implementation level management, administration, information and monitoring actions. Recreation and visitor services planning, management and monitoring is an iterative process that includes evaluating the success of actions in achieving the land use plan decisions.

RECREATION USE

The Recreation Management Information System estimates participation of recreational activities recorded at BLM-administered sites and areas. Estimates are based on observations and professional judgment because there are no fee sites to record registration within the planning area. Visitation rates are estimated by numbers of participants and visitor days. Participants are the actual number of people who take part in a recreational activity. A visitor day is a common unit of measure of recreation used among federal agencies and one visitor day represents an aggregate of 12 visitor hours at a site or area.

Reported recreation-related visitor use days over the last 5 years in the planning area are estimated at over 506,731 visits. In 2009 dispersed use across the planning area was estimated at over 106,000 visits annually. By 2013 visitor use had grew to 301,682 visits annually (RMIS, report #26, 11/1/2013). This growth is on track with other research found throughout the state and in continuum with the influx of population from the nearby

oil and gas boom. According to the "Executive Summary" completed by the *University of Montana in Missoula, MT, Institute for Tourism and Recreation Research,* preliminary estimates for 2012 had a 3 percent increase to 10.9 million nonresident travelers to the state of Montana from 2011.

The highest participation by activity include hunting, wildlife viewing, driving for pleasure, fishing, picnicking, camping, target practice, and hiking. Hunting had the most visitor days out of the top 10 recreation activities in the planning area, with approximately 136,692 participants spending more than 59,583 visitor days in 2009 alone. In 2013, this number had grown to approximately 146,037 participants. Approximately 82,466 participants viewed wildlife for more than 12,069 visitor days, while approximately 8,678 participants spent more than 2,165 days fishing and 9,099 participants used 11,580 visitor days for camping. In 2013, scenic driving/driving for pleasure grew to a very high number at 25,903 participants while hiking also grew to 55,340 participants for the MCFO.

Popular activities within developed recreation sites vary for each site. For example, OHV use at the Glendive Short Pine OHV area averages approximately 2,000 participants and 1,000 visitor days annually, Knowlton and Hay Draw TMAs are very popular for dispersed big game hunting and camping, and Matthews and Howrey Island are popular for fishing, day use, and camping.

SPECIAL RECREATION PERMITS

The MCFO administers special recreation permits to manage organized commercial and noncommercial recreation activities. Special recreation permits are issued to accommodate six categories of recreational use, as follows: commercial, competitive, vending, individual or group use in special areas, organized group activity, and event use. Lengths of permits depend on the activities proposed, areas in question, and the past record of the potential permittee. Permits may be issued for periods of up to 10 years but are for day use only.

The MCFO manages approximately 50 special recreation permits each year, and the primary activity for these permits is big game hunting. Most hunting outfitter or guides pursue mule deer, white-tailed deer, pronghorn, elk, and upland birds. Currently, there are no hunting camps existing on BLM-administered lands within the planning area.

Special recreation permits are also issued for OHV group riding events, paleontological events, trail runs, horseback riding, and trail rides. All existing permits have been issued on a first-come, first-served basis. Fee collecting for these special recreation permits are used to offset administrative costs, monitor approved activities, and protect recreation resource values for future use.

Trends

The current trends in recreational use in the planning area indicate a steady increase. Many of the recreational activities are directly tied to various natural resources and correlation between the condition of the resources and the number of users. The recreation trends tied most directly to resource conditions are those that require healthy wildlife populations. These include hunting and fishing recreation trends. Annual precipitation will affect the level of rivers, reservoirs, and streams and related recreation, such as fishing and floating. Given favorable conditions for these resources, their recreational use will likely continue to rise.

TRAVEL MANAGEMENT AND OHV USE

The MCFO currently manages approximately 2,400 acres of OHV Open Areas, 2,750,000 acres of OHV Limited Areas, which is currently limited existing routes, and 80 acres of OHV Closed Areas. The open areas are Glendive Short Pines OHV Area and Terry OHV area, which are described in more detail under the Recreation section. These open areas are generally defined as areas with no restrictions on which OHVs can be driven.

BLM regulations require that all BLM-administered lands be designated as Open, Limited, or Closed to OHVs (43 CFR 8342.1). As part of the travel management planning process, the designation will change from limited to existing roads, primitive roads, and trails to limited to designated roads, primitive roads, and trails upon the

completion of travel management planning. Travel management will continue to be addressed at the site-specific planning level. The vast majority of OHV use throughout the planning area is limited to existing roads and trails. Areas within the planning area will be addressed through future travel management planning by initiating implementation level plans for 14 travel management areas. Please see the *Recreation Appendix* for more information on these areas.

In addition, a travel management plan is not intended to provide evidence bearing on or addressing the validating of any R.S. 2477 assertions. R.S. 2477 rights are determined through a process that is entirely independent of the BLM's planning process. Consequently, travel management planning should not take into consideration R.S. 2477 assertions or evidence. Travel management planning should be founded on an independently determined purpose and need that is based on resource uses and associated access to public lands and waters.

Public expectations and demand for motorized and non-motorized recreation has changed substantially. Advances in motorized and non-motorized recreation travel technology and use have increased the public's ability to traverse conditions and terrains not previously predicted. As a result, there is increased conflict between motorized and non-motorized users. Public interest and demand for motorized and non-motorized travel opportunities are expected to continue to increase.

TRAVEL MANAGEMENT PLANS

Areas within the planning area with existing travel plans include the Knowlton and Hay Draw Travel Management Areas (TMAs). Brief descriptions of these areas follow.

The Knowlton TMA is located approximately 40 air miles east of Miles City, in portions of Custer and Fallon counties. The area encompasses approximately 40,000 acres of BLM-administered land with approximately 17,000 acres with legal public access. The proposal was developed using a community-based decision making process facilitated by the Eastern Montana Resource Advisory Council. The objectives of the plan are to increase wildlife security through a reduction in motorized vehicle impacts, reduce motorized vehicle impacts to non-motorized users, and provide some allowance for motorized, on-road big game retrieval to assist hunters in retrieving downed big game animals.

The Hay Draw TMA is located in Carter County, approximately 21 air miles east of Broadus, Montana. The project area encompasses approximately 19,300 acres of BLM-administered lands and approximately 12,840 acres of school trust land. The objectives of the plan are to provide motorized access within a reasonable distance of hunting opportunities on BLM-administered land and maintain the integrity of the crucial mule deer and pronghorn winter range habitat.

TYPE OF OHV USE

OHV use is a popular method to explore public lands, and it provides access for non-motorized recreational purposes, such as fishing, hiking, mountain biking, horseback riding, and primitive camping opportunities. Motorized OHV use in the planning area consists primarily of riding and driving ATVs, motorcycles, and full-sized trucks and vehicles for pleasure. Participation in these recreational activities varies by season, topography, vegetative cover, and number of people taking part in the activity. Public lands in the planning area provide many opportunities for OHV use, varying from backcountry to concentrated-use areas.

Snowmobile use also occurs within the planning area and snowmobile use is mostly unrestricted on BLM-administered lands within the planning area when snow cover is adequate.

OFF-HIGHWAY VEHICLE ACCESS

Existing roads and trails, some of which are user created, provide access to the general areas where most recreation activities take place on public lands in the planning area. Roads and trails already lead to most site-

specific recreation spots, such as dispersed camping and picnicking sites, water-related access sites, and viewing areas but the public land ownership pattern in the planning area is highly fragmented, which results in access difficulties and potential conflict. Conflicts over access can take place wherever fragmented ownership occurs (such as along waterways) or wherever prime resource values occur and recreation or other user demands are high. Even where access exists, confusion about access and can result in conflicts among the public, public land administrators, and owners of associated or intermingled private lands.

REASONABLY FORESEEABLE FUTURE USE

Demand for access to public lands is expected to increase while public access to private lands is expected to decrease over time, and a number of factors, including public awareness, increased tourism, and increased restrictions by private landowners, are responsible for this trend. Federal, state, and local agency marketing efforts to increase tourism are expected to increase visitation. With an increase in non-local users, demand for commercially guided activities (such as hunting, fishing, and sightseeing) will increase. However, demand is expected to increase much faster than the BLM's ability to acquire new access. Continued private acquisition and fencing is expected to decrease land availability and limit access, causing local users' demands on public land to increase. OHV use will continue into the future; however, the general lack of understanding of land use ethics have increased inappropriate uses of OHVs on federal lands and represent management challenges for the BLM.

LANDS AND REALTY

Lands and realty involves issues of land disposal, acquisition, use, ROW corridors, withdrawals, and transportation systems. Although FLPMA directed the BLM to retain public lands, lands and realty issues arise regularly, often accompanying other resources or resource concerns. This section addresses each of these areas as they apply to the planning area.

LANDS AND REALTY OWNERSHIP PATTERNS

A complex history of homestead and railroad land grants has caused generally fragmented surface and subsurface mineral ownership. Lands containing all federally owned minerals are either public domain or lands in which the surface area was patented under the Stock Raising Homestead Act of 1916 (BLM 1984 and 1995). The Bankhead-Jones Farm Tenant Act (Title III) of 1937 authorized the federal purchase of privately owned farmlands, known as Land Utilization (LU) Project Lands. These sub-marginal lands were incapable of producing sufficient income to support the family of each farm owner. The owner and family were relocated elsewhere, and the sub-marginal lands retired from agricultural production. These LU Lands, which were purchased by the Federal Government were administered under Title III of the Bankhead-Jones Farm Tenant Act and subsequently transferred by various Executive Orders between 1949 and 1960 from jurisdiction of the U.S. Department of Agriculture to the U.S. Department of the Interior, and subsequently administered by the BLM. Section 33 of the Act provided that:

> "As soon as practicable after the end of each calendar year, the Secretary shall pay to the county in which any land is held by the Secretary under this title 25 per centum of the net revenues received by the Secretary from the use of the land during such year. Payments to counties under this section shall be made on the condition that they are used for school or road purposes, or both."

Ownership or administration of surface and subsurface rights also extends to other federal, state, tribal, or private interests in the planning area. These agencies include the Fort Peck Tribe, the Bureau of Reclamation (BOR), USFS, USFWS, Bureau of Indian Affairs (BIA), Crow Tribe, Northern Cheyenne Tribe, and the State of Montana as well as local counties and private entities within the planning area. The USDA administers the lands containing the Fort Keogh Livestock and Range Research Laboratory, which is located southwest of Miles City.

PRIMARY LAND USES

The primary uses of public lands in the planning area include livestock ranching; recreation; and major oil, gas, and coal development. The latter industrial developments occur primarily in Fallon, Richland, Roosevelt, Dawson, Wibaux, Big Horn, Rosebud, and Sheridan counties. Other land uses may include transportation, utility and communication systems that provide services to the planning area. In addition, several wildlife refuges have been established in support of recreation activity including the Charles M. Russell National Wildlife Refuge, Medicine Lake National Wildlife Refuge, Lamesteer National Wildlife Refuge, Fox Lake Wildlife Management Area, and game management areas within the planning area. The principle recreation areas occur primarily in the Custer National Forest (at the southern boundary of the planning area) and along the Yellowstone, Powder, Tongue, Missouri, and Little Missouri rivers. These areas offer a variety of dispersed recreational opportunities.

Rights-of-Way

ROWs across public lands are generally authorized under Title V of FLPMA and Section 28 of the Mineral Leasing Act (43 CFR 2800 and 2880 and 30 U.S.C. 181 et seq.) or pursuant to U.S.C. Title 23, Section 317 for highways under the Federal Aid Highway Act of 1958 (August 27, 1958, as amended). In areas in which ROWs are allowed, stipulations from the BLM Handbook 2801-1 are used to protect resource values.

The planning area contains various types of federally authorized ROWs, which typically include uses for utility and transportation purposes, communication sites, water-related facilities (such as ditches, canals, dikes, wells, reservoirs, and water pipelines), oil and gas pipelines and associated facilities. There are approximately 919 authorized ROWs on BLM-administered lands within the planning area, affecting 84,314 acres of federal surface. Of these authorized ROWs, 282 (affecting 2,840 acres) are subject to rental payments. On average, 25 ROWs are issued each year; but demand has increased in recent years.

The 1996 Big Dry RMP identifies ROW avoidance areas that include cultural and wildlife ACECs, Makoshika State Park (lands since patented to MFWP), and SRMAs. The Smoky Butte ACEC was designated a ROW exclusion area (BLM 1996). In previous planning efforts, ROW corridors were considered but not carried forward due to fragmented federal ownership pattern in the planning area. Applicants are encouraged to locate new facilities within existing ROWs (BLM 1985c and 1996).

Communication Sites

Ten existing sites have communication site plans in place and these plans are updated, as needed, or if additional uses are authorized (Table 3-34). There is one other small communication site without a site plan authorized in the planning area, as described below:

- The Smoky Butte ACEC site, which may have a plan developed on it in the future with a television repeater station (T. 18N, R. 36E, Section 12, NWSW)

Unauthorized Uses

Unauthorized land uses also occur in the planning area (BLM 1985c, 1996, 2010g). These unauthorized uses generally include agriculture, occupancy, exclosures, abandonments of property or trash, and ROWs. For these types of unauthorized uses, most of the cases are small, agricultural trespasses that are fewer than 10 acres in size.

TABLE 3-34. COMMUNICATION SITES WITH PLANS IN THE PLANNING AREA

Communication Site	Legal Location[1] (Principal Meridian Montana)	Number of Facilities	Type of Site and Use
Alzada	T. 8S, R. 57E, Sec. 10, SENE	3	Non-broadcast two-way cellular and microwave uses
Belle Prairie	T. 16N, R. 57E, Sec. 22, SWNW	1	Non-broadcast, two-way, cellular and microwave uses
Fallon	T. 14N, R. 52E, Sec. 32, SW	1	Non-broadcast, two-way, cellular, and microwave uses
Flowing Well	T. 18N, R. 43E, Sec. 8, NE	2	Non-broadcast, two-way radio, cellular, and microwave uses
Fort Peck	T. 26N, R. 42E, Sec. 9, NE	1	Non-broadcast cellular and microwave uses
Locate	T. 8N, R. 53E, Sec. 27, NW	1	Low power non-broadcast uses
Lookout Butte	T. 6N, R. 60E, Sec. 4, NESW	1	Low power broadcast translator uses
Rosebud Buttes	T. 5N, R. 42E, Sec. 24, NE	2	Full power broadcast and other low-power non-broadcast and low-power broadcast uses
Sheep Mountain	T. 15N, R. 47E, Sec. 24, NW	2	Government only non-broadcast two-way radio uses
McGuire Creek	T. 21N, R. 43E, Sec. 13, NW	1	Low power, non-broadcast, cellular, and two-way radio

[1]These legal descriptions do not delineate the boundaries of the right-of-way use areas, but give approximate locations. Boundaries of the use areas are defined in individual site plans.

Land Use Authorizations

Other unauthorized uses relating to occupancy include abandoned structures (e.g., mobile homes) or agricultural structures (e.g., barns). Unauthorized exclosures typically consist of fences used to protect sources of water or other natural resource features installed on public lands without prior approval. Unauthorized ROW trespasses consist of utility and transportation uses, communication sites, oil and gas pipelines, roads, and water-related facilities installed on public lands without proper approval.

Roadways

The planning area also includes several major roads and highways that provide access to public lands. Examples of major highways include Interstate 94, which crosses through the center of the planning area as well as a variety of state highways. For example, State Highways 2, 13, 16, 24, and 201 traverse the northern segment of the planning area, while State Highways 22, 200, 12, 39, 59, 323, and 212 are located in the central and southern segments of the planning area. The State of Montana, local counties, BLM, USFS, and private individuals and corporations maintain roads and highways in the planning area.

Leases and permits, authorized under Section 302 of FLPMA for various land uses, are spread throughout the planning area. Two Section 302 leases have been issued to coal companies for land use related to coal mining. Fifteen Section 302 permits are authorized in the planning area, with eight for agricultural uses (farming) and the rest for various uses (including a shop, a garage, a shed, gravel storage, a monitoring well, and environmental monitoring and coal mine reclamation). Short-term permits are issued for filming purposes. All of these leases and permits are subject to rental payments. The USFS issued eight permits on Bankhead-Jones lands prior to those lands entering under BLM's administration. These permits are for two roads, two pipelines, a barn and granary, a telephone line, a reservoir, and stock water storage. Only one of these permits was subject to rental payments (which was paid in full) while the other seven were not (BLM 2010g).
The Recreation and Public Purposes Act (R&PP) of June 14, 1926 (43 U.S.C. 869 et seq.), as amended, authorizes the lease of public lands for recreational or public purposes to state and local governments and to

qualified non-profit organizations. There are no current R&PP leases authorized within the planning area (BLM 2010g).

Land Tenure (Including Access)

Land tenure (or land ownership) adjustment refers to those actions resulting in the disposal of BLM-administered land or the acquisition of nonfederal lands or interests. In the planning area, these actions have normally included sales (offered on the initiative of the BLM often in response to public requests), exchanges, transfers, direct purchases, and withdrawals. See Map 14 for land pattern adjustment and access information. The planning area has a scattered land pattern of approximately 4,536 tracts of federal BLM-administered land in 1,194 townships and 40,780 sections.

For sales to occur, the tract of public land, which must be identified through land use planning, must meet one or more of the following disposal criteria (Section 203(a) of FLPMA) described below.

- It is difficult and uneconomical to manage as part of the public lands and is not suitable for management by another federal department or agency;
- It was acquired for a specific purpose and the tract is no longer required for that or any other federal purpose;
- Disposal of the tract will serve important public objectives; and
- The land description can be derived from official surveys.

There were 41,181 acres of public land identified in the Powder River RMP for possible disposal by sale, but no sales have been completed (BLM 1985c). A 640-acre tract of land was identified in the Big Dry RMP to be sold to Fallon County for a sanitary landfill and was completed in September of 2001 (BLM 1996). Although this is the only sale completed recently in the planning area, several others were completed in the early to mid-1980s (BLM 2010g).

The R&PP Act authorizes the sale of public lands for recreational or public purposes to state and local governments and to qualified non-profit organizations. Eight R&PP patents have been issued in the planning area; of these, three (for a game management area and two parks) were issued before the Powder River and Big Dry RMPs were completed. The Powder River RMP identified 331 acres of public land with potential for community expansion that could be considered for disposal under the R&PP (BLM 1985c). Four patents were issued for 36.02 acres in the Powder River RMP area: 0.84 acres for an historic cemetery in Carter County (1988), 11.83 acres for a college rodeo arena (1992), 7.72 acres for an administrative site for MFWP (1994), and 15.63 to the Eastern Montana Fair Board for Horseman's Park (1998). The Big Dry RMP identified 2,700 acres of public land to be patented (under the R&PP) to MFWP as an addition to the Makoshika State Park (BLM 1996). Within the Big Dry RMP area, the Makoshika State Park R&PP patent was issued for 2,699.64 acres on June 6, 2000 (BLM 2010g).

The Powder River RMP categorized 123,542 acres of public land for potential disposal through exchanges or jurisdictional transfers (BLM 1985c). Disposal, retention, and acquisition criteria were established, and the disposal and retention lands identified on a map. The BLM would consider proposals from the public and react to other land adjustment proposals. Improved land ownership patterns would be achieved using exchange as the preferred method of land transaction (BLM 1985c). There have been 52,613.31 acres of public land disposed of in 15 exchanges in the Powder River RMP area and 23,324.10 acres acquired by exchange. One of these exchanges was an assembled land exchange in which 15,572.93 acres of scattered parcels of federal land were disposed of and 14,036.79 acres were acquired, which created a block of federal land of just over 20,500 acres. Ten of these exchanges were one-on-one exchanges where 12,912.50 public acres were disposed of and 9,287.31 acres of private land were acquired to block up with other public land. Following completion of one of these exchanges, the USFS received 1,036.91 acres of acquired land via jurisdictional transfer and the BLM acquired two access easements as a part of two of these exchanges. The Billings RMP area (under the jurisdiction of the Billings Field Office) used 11, 519.44 acres of public land in the Powder River RMP area for two pooling exchanges, but MCFO did not acquire any lands within the Powder River RMP area (under jurisdiction of the MCFO) through these two exchanges. There were 8,175.30 acres of public land patented

within the Powder River RMP area to the State of Montana in the Phase III Exchange for the Crow Boundary Settlement Act (25 U.S.C. 1776), and 4,433.14 acres were patented within the Powder River RMP area to private individuals in the Phase IV Exchange for the Crow Boundary Settlement Act. The MCFO did not acquire any lands within the Powder River RMP area through these exchanges (BLM 2010g).

The Big Dry RMP provided that emphasis be placed on land tenure adjustment and easement acquisition within the planning area (BLM 1996). All land exchanges will be based on willing buyer and willing seller. The goal of the lands program is to consolidate the scattered public lands, increasing management efficiency and accessibility. Disposal, retention, and acquisition criteria were established, and disposal and retention areas identified on a map. Exchanges or acquisitions will be considered to acquire desirable tracts within the disposal areas or to add to existing public lands within those areas meeting the long-term management objective criteria. Individual tracts or parcels in the retention areas will be disposed or repositioned through sale or exchange when significant management efficiency, greater public values, or other objectives would be met. There were 6,586.05 acres of public land patented to the State of Montana within the Big Dry RMP area in the Phase II and III exchanges for the Crow Boundary Settlement Act. No other exchanges have been completed within the Big Dry RMP area (BLM 2010g).

Access easements are acquired to provide legal access to isolated tracts of public land and can also be made a part of land exchange and sale transactions for access purposes (BLM 1985). The purchase of easements, execution of land exchanges, validation of Revised Statute 2477 ROWs, and reciprocal ROWs will continue to improve access (BLM 1996). The Land Pattern Adjustment and Access Map (Map 14) identifies “Access Priority Areas” (High, Medium and Low) where BLM has goals to acquire public access to BLM-administered surface. There are 35 easements on record within the planning area: 7 non-exclusive easements for stockwater pipelines, 15 old exclusive (providing public access) access road easements, (3 of which were acquired as part of land exchanges and 1 easement that was acquired in return for a reciprocal ROW), and 13 easements acquired for access roads, since the Powder River and Big Dry RMPs were completed (BLM 2010g). Six of the most recently acquired easements provided public access to approximately 55,000 acres of BLM-administered land and approximately 13,000 acres of State Land.

Multiple navigable rivers cross the planning area. By the Equal Footing Doctrine the State of Montana obtained the title to the beds of these rivers. Determining ownership of the riparian lands, islands, and locating public river access can be complex. River movement moves public land boundaries. Islands form and disappear raising further ownership questions. Management actions in these areas must be carefully researched and documented in the event of legal challenges to BLM's assurance of ownership.

The MCFO includes approximately 2.75 million acres of BLM-administered surface. Of this total, nearly1.6 million acres are considered publically accessible; leaving over 1 million acres non-accessible. Publically accessible BLM lands are generally those that are accessible overland without gaining permission from a non-BLM interest. This access can occur through State or County roads, BLM roads or easements, or through other publically accessible lands,; by either motorized or non-motorized means. Gaining public access to over 1 million acres of BLM administered public land is a BLM priority and would occur through the various land tenure actions.

There was one land transfer within the planning area from another agency to the BLM when the Army Corps of Engineers transferred 242.60 acres of land declared excess within the Big Dry RMP area in 1993 (BLM 2010g).

Total withdrawals in the planning area include approximately 441,168 acres (BLM 1985c, 1996, 2010g) (Table 3-35). The withdrawals are either recommended for continuation of existing withdrawal or recommended for revocation of withdrawals. For continuation of existing withdrawals, all withdrawals and extensions on BLM-administered lands, having a specific period, must be reviewed by the Secretary of the USDI at least two years before expiration. The withdrawals may be extended or further extended only upon compliance with procedures at 43 CFR 2310.4, and only if the Secretary determines that the purpose for which the withdrawal was first made requires the extension (and then only for a period no longer than the length of the original withdrawal period). For revocation actions, once relinquished, these lands would be opened to the public land laws and managed in a manner similar to that on adjacent public lands. See the *Lands and Realty-Renewable Energy Appendix* for more detailed descriptions of these withdrawals.

TABLE 3-35.
LAND WITHDRAWALS IN THE PLANNING AREA

Type of Withdrawal	RMP Area	Name or Location	Acres Withdrawn
Continuation	Big Dry	International Boundary	293
	Big Dry	Medicine Lake National Wildlife Refuge	24,508
	Big Dry	Fox Lake Game Management Area	160
	Big Dry	Bureau of Sports Fisheries and Wildlife Waterfowl Production Area	26
	Big Dry	Charles M. Russell National Wildlife Refuge	290,222
	Big Dry	Corps of Engineers (Fort Peck)	3,756
	Big Dry	Fort Union Trading Post National Historic Site	62
	Big Dry and Powder River	Fort Keogh Livestock Experiment Station	55,765
	Powder River	Belltower Town site	80
	Powder River	BIA-Northern Cheyenne Trust-Water Rights Settlement	320
	Powder River (a portion is within the Billings Field Office area)	BIA-Crow Trust-Crow Boundary Settlement	9,873
Continuation Subtotal			**385,065**[1]
Revocation	Big Dry	Lower Yellowstone Project	51,872
	Big Dry	Fort Buford Project	914
	Big Dry	Public Water Reserve 107 (McCone)[2]	238
	Big Dry	Milk River Project	37
	Big Dry	Corps of Engineers (Fort Peck)[2]	206,976
	Big Dry	Buffalo Rapids Project (BOR)	305
	Powder River	Power Sites Classification (Moorhead Reservoir area, surface only)	2,777
	Powder River	Tongue River Reservoir	160
Revocation Subtotal			**263,279**
Total Acres of Withdrawals			**441,168**[1]

[1] Of the 238 acres in Public Water Reserve 107, 200 lie within the Charles M. Russell National Wildlife Refuge. These acres are not included in the total acres of withdrawals.
[2] All of the Fort Peck Dam area overlaps the Charles M. Russell National Wildlife Refuge, so these acres are not included in the total acres of withdrawals.

RENEWABLE ENERGY

Renewable energy includes solar power, wind, biomass, and geothermal resources (see the *Forestry* section for biomass and the *Minerals* section for geothermal leasing). As demand for clean and viable energy to power the nation has increased, consideration of renewable energy sources available on public lands has come to the forefront of land management planning. No special management provisions were considered in the Powder River and Big Dry RMPs specifically concerning renewable energy resources (BLM 1985c and 1996). Applications for renewable energy ROWs for wind and solar projects would be analyzed on a case-by-case basis although there has been no demand for these projects on public lands in the planning area to date. The potential for renewable energy in the planning area is based on environmental, physical, and economic criteria in conjunction with policy directives. The BLM would analyze proposals for renewable energy development on a case-by-case basis and authorize those that were consistent with resource management goals. The United States Department of Energy's National Renewable Energy Laboratory (NREL) maps and information would be used when considering and evaluating wind and solar project proposals and applications. The NREL web site is available at http://www.nrel.gov/.

In cooperation with the NREL, the BLM assessed renewable energy resources on public lands in the western United States (BLM and NREL 2003). The assessment reviewed the potential for concentrated solar power, photovoltaic, wind, biomass, and geothermal on BLM-, Bureau of Indian Affairs (BIA)-, and USFS-administered lands in the west. Hydropower was not addressed in the BLM and NREL report. The BLM and NREL report did not identify the MCFO as one of the top 25 BLM planning units with the highest potential for any kind of renewable energy but the MCFO was rated as favorable for wind power with a high potential for renewable power. In June 2005, the BLM also prepared a *Wind Energy Development Programmatic Environmental Impact Statement* (BLM 2005c, Wind Energy EIS) to evaluate issues associated with wind energy development on western public lands administered by the BLM. The Wind Energy EIS established policies and BMPs for the administration of wind energy development activities and minimum requirements for mitigation measures for wind projects on BLM-administered lands. Analyses conducted in the Wind Energy EIS support the amendment of specific land use plans where potentially developable wind resources are located. The plan covers an 11-state study area and identifies BLM RMPs that should be amended under the Wind Energy EIS; however, this RMP and the previous RMPs managed by the MCFO (the Powder River and Big Dry RMPs) are not mentioned in the Wind Energy EIS because this RMP revision addresses this issue directly. Proposed amendments include adoption of the proposed programmatic policies and BMPs as well as identification of specific areas where wind energy development would not be allowed. WO IM No. 2009-043 (BLM 2008e) updates and clarifies the policies and BMPs provided in the Wind Energy EIS. BLM's Washington IM 2010-077 also provides guidance for wind energy cases.

The BLM prepared a plan (2012f) to evaluate utility-scale solar energy development, amend relevant BLM land use plans in consideration of establishment of a new BLM solar energy development program, and develop and implement agency-specific programs. These programs would facilitate environmentally responsible utility-scale solar energy development by establishing environmental policies and mitigation strategies related to solar energy development in six western states (Arizona, California, Colorado, New Mexico, Nevada, and Utah). The study area has been limited to these six states because they encompass the most prospective solar energy resources suitable for utility-scale development over the next 20 years. Current BLM guidance to facilitate the processing of ROW applications for solar energy projects on public lands can be found on the BLM's web page at: http://blmsolar.anl.gov.

WIND RESOURCES

The American Wind Energy Association ranks Montana fifth in the nation for wind-energy potential (AWEA 2010). As a renewable resource, wind is classified according to wind power classes, which are based on typical wind speeds. These classes range from Class 1 (the lowest) to Class 7 (the highest). In general, at 50 meters, wind power Class 4 or higher can be useful for generating wind power with large turbines. Class 4 and above are considered to have high potential for development based on 50-meter mapping, although some Class 3 areas may have increased potential for development based on higher wind speeds at 80-meter heights. Possible high wind shear could cause higher wind power class values at 80 meters than those shown on the 50-meter map in particular locations in the Class 3 areas. This map indicates that the planning area has wind resources consistent with utility-scale production. Approximately 548,000 acres of BLM administered land within the planning area are rated at a Level 4 (Good) or above for wind potential. Map 38 identifies the wind potential of BLM-administered surface in the planning area, Classes 1 through 7, based on 50-meter data, by low (Classes 1 and 2), moderate (Class 3), and high potential (Classes 4 through 7).

Since the completion of the Big Dry and Powder River RMPs, there have been no wind energy generation facilities authorized on BLM-administered lands within the planning area. Although there have been a few inquiries about the possibility of erecting wind turbines sites on BLM-administered lands, no applications have been submitted and subsequently no authorizations have occurred.

Montana Dakota Utility's Diamond Willow Wind Farm near Baker, Montana, is the only known existing (there are no known proposed) utility-scale wind project within the planning area (Montana Department of Commerce 2010b). It is not located on BLM-administered lands. This facility, which was completed in 2008, includes 13 turbines and a total capacity of 19.5 megawatts (additional turbines may be added to this site in the future). However, smaller proposals (less than 10 towers) may be encountered in the near future because of incentives

offered to municipalities for such development. Despite this current low level of interest in wind energy, it is possible that with improvements in technology and a more favorable economic climate, interest in the development of wind energy facilities on public lands may increase.

SOLAR RESOURCES

Utility-scale solar energy facilities are facilities that can generate large amounts of electricity for direct input to the electricity transmission grid. Solar energy technologies potentially suitable for use in utility-scale applications include concentrating solar power technologies and photovoltaic technologies.

Concentrating solar power plants generate electric power by using mirrors to concentrate (focus) the sun's energy and convert it into high-temperature heat, which is then channeled through a conventional generator.

The plants consist of two parts: one that collects solar energy and converts it to heat and another that converts the heat energy to electricity. The BLM and NREL study (2003) did not identify any BLM-administered lands within the planning area with a high potential for this type of energy source and indicated that the potential for this type of renewable energy lies primarily in states to the south and southwest of Montana. In keeping with this assessment, the MCFO has not had any expressions of interest in developing concentrating solar power facilities on public lands.

Photovoltaic technologies convert the sun's radiant energy directly to electricity. Photovoltaic technologies use solar panels to capture light energy from the sun and then use that light energy to drive an electric current. The BLM and NREL study (2003) did not identify the MCFO as one of the top 25 BLM planning areas for photovoltaic potential. The MCFO has not authorized any photovoltaic facilities strictly for commercial power production, nor has interest been expressed by industry in developing such facilities on BLM-administered lands in the planning area. Since the completion of the Big Dry and Powder River RMPs, there have been no solar energy facilities authorized on BLM-administered lands within the planning area. There are no known existing or proposed utility-scale solar projects within the planning area (Montana Department of Commerce 2010b).

Localized, small-scale solar projects utilizing photovoltaic panels to power livestock wells occur in the planning area, but are developed under specific resource program provisions rather than authorized via a ROW grant.

SPECIAL DESIGNATION AREAS

AREAS OF CRITICAL ENVIRONMENTAL CONCERN

ACECs are unique to the BLM and can only be designated on BLM-administered surfaces. BLM regulations define an ACEC as an area "within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards" (43 CFR Part 1610). While an ACEC may emphasize one or more unique resources, other existing multiple use management can continue within an ACEC as long as the uses do not impair the values for which the ACEC was designated. The MCFO administers 16 designated ACECs (Table 3-36). In addition, several areas were nominated for ACEC consideration (see the *Special Designations Appendix*, Nominated ACECs for more information.) See Map 39 for existing and nominated ACEC general locations.

Ash Creek Divide

The Ash Creek Divide ACEC, located in Garfield County, has produced fossils and research data proven significant to the national and global scientific communities. This area has also generated scientific papers and yielded information regarding the types of animals and plants present, the environment in which they lived, and

TABLE 3-36.
AREAS OF CRITICAL ENVIRONMENTAL CONCERN
ADMINISTERED BY THE MILES CITY FIELD OFFICE

ACEC	Reason for Designation	Acres
Ash Creek Divide	Paleontological resources	7,931
Battle Butte	Cultural resources	120
Big Sheep Mountain	Cultural resources	360
Black-footed Ferret Reintroduction	Wildlife	11,166
Bug Creek	Paleontological resources	3,840
Finger Buttes	Scenery	1,520
Hell Creek	Paleontological resources	19,169
Hoe	Cultural resources	144
Howrey Island	Threatened and endangered wildlife	321
Jordan Bison Kill	Cultural resources	160
Piping Plover	Wildlife	16
Powder River Depot	Cultural resources	1,386
Reynolds Battlefield	Cultural resources	336
Sand Arroyo	Paleontological resources	9,056
Seline	Cultural resources	80
Smoky Butte	Geology, recreation	80
Total		**55,685**

The cause of the mass extinction at the close of the Cretaceous Period. The Ash Creek Divide provides an example of the fossil record through exposed bedrock and high quality preserved fossils. The area is expected to provide further data as new material weathers out of the rock.

Battle Butte

The Battle Butte Battlefield is one of twelve major battlefields of the Sioux War of 1876. This war and associated sites are of major interest to national historians, history enthusiasts, and the Sioux, Crow, and Cheyenne Tribes. The Battle Butte ACEC, site of the Battle Butte or Wolf Mountains Battle, is located in Rosebud County. The battle was fought on January 8, 1877, in a blinding blizzard. Led by army scout Yellowstone Kelly, Colonel Nelson Miles commanded a force of 436 men composing seven companies of the 5th and 22nd Infantry. They marched from the Tongue River Cantonment south along the Tongue River in search of American Indian winter villages. After a 10-day march up the river, Miles' command encountered warriors from Crazy Horse's winter camp of 1,200 inhabitants located south of Birney, Montana. Estimated at 600 warriors, the Sioux attacked west of the Tongue River and then occupied the high ground (Battle Butte) to the south of Miles' forces. The Sioux held the advantage, firing down into the U.S. soldiers' positions before Colonel Miles ordered his men to attack uphill to take command of this position. Once Miles' men were able to hold the high ground, the Sioux's advantage was lost. Low on ammunition, the Sioux retreated upstream and were able to escape up the Tongue River in the ensuing blizzard.

Big Sheep Mountain

The Big Sheep Mountain ACEC is located in Prairie County and represents a range of cultural periods dating back approximately 10,000 years. Early residents used the area repeatedly and material left behind provides important information about time sequences and changes in use. The site contains projectile points, fire hearths, bone and tooth fragments, stone tools, and rock chips. The site's unique properties may contribute important scientific information on nearly the full range of cultural traditions from the Paleo-Indian period to the Late Plains Archaic Period (3,000 to 1,500 B.P.)

Black-footed Ferret Reintroduction

The Black-footed Ferret Reintroduction ACEC is located in Custer and Prairie counties. The black-footed ferret is an endangered species dependent on prairie dog colonies. This area was considered a potential reintroduction area because it had been documented in recent past as containing the largest active prairie dog complex on

public lands within the MCFO. When this ACEC was designated, it contained approximately 1,151 public acres of active prairie dog towns, but at the time of the last comprehensive survey effort (2004), plague had reduced the active area to less than 100 acres on public lands within the ACEC.

Generally, the USFWS minimum habitat guidelines for black-footed ferrets to be considered for possible re-introduction include prairie dog colony "sub-complexes" of 1,500 acres in size or larger. Although the ACEC combined with adjacent deeded lands may meet or be close to meeting this minimum size requirement (dependent on plague outbreaks) across all ownerships, the acreage of active prairie dog towns that occur on public lands do not currently meet this requirement. The Montana Prairie Dog/Black-footed Ferret Working Group gathers data on prairie dog distribution, colonies, complexes, etc., and assesses the potential for black-footed ferret reintroduction sites. This working group would steer any potential future re-introduction efforts within the MCFO.

Bug Creek

The Bug Creek ACEC, located in McCone County, contains portions of the Hell Creek formation and the overlying Tullock member of the Fort Union formation, which are significant for paleontological resources spanning the late Cretaceous Period (100 to 65 million years ago) to the early Tertiary Period (65 to 25 million years ago). The outcrops of these beds are some of the few places in the world that preserve a continuous record before, during, and after the mass extinction of the dinosaurs and other major life forms. Because it contains extensive exposures of bedrock and quality preserved fossils, the Bug Creek area is one of the preeminent and most studied examples of this fossil record. Fossils and other data collected in this area yield information about the end of the dinosaur age and the start of the mammal age.

Finger Buttes

The Finger Buttes ACEC is located in Carter County and no legal access is available. Part of the Arikaree formation, the Finger Buttes represent more than badlands topography (typical topography for southeastern Montana) and contain scenic qualities of color, line, and form in tall, slim, smokestack-like tan to gray sandstone monuments, towers, and prominences. Highlighted against the horizon, the scenic values are unique and do not exist elsewhere in the region.

An area in Carter County has been identified for an oil and gas MLP (see *Oil and Gas* for more information on MLPs). The 1,521 acres Finger Buttes ACEC, which was designated for scenic values in 1996, is located within the MLP area. The ACEC has low potential for oil and gas development. For more information on the ACEC, see the *Special Designation Areas Appendix.*

Hell Creek

The Hell Creek ACEC is located in Garfield County. The Hell Creek ACEC's fossils and research data are significant to the national and global scientific communities, generating scientific papers and populating museum displays. Comparison of fossils and other data collected yielded information about the types of animals and plants that occurred in the area, the environment in which they lived, and the cause and effects of the mass extinction at the close of the Cretaceous Period. Approximately one-half of the Hell Creek NNL is included within the ACEC boundaries. The area is expected to provide further data as new material weathers out of rock.

Hoe

The outstanding feature of the Hoe ACEC, located in Prairie County, is three bison scapulas (shoulder blades) used as gardening hoes). American Indian use, documented by projectile points and pottery fragments, occurred during the Late Prehistoric Period (1,500 BP to 200 BP). Several fragments of pottery, a bone awl, stone tools and flakes, and fire-cracked rock indicate farming and non-nomadic lifestyles, typical of the tribes in the middle Missouri River region in North and South Dakota that lived in permanent villages and tended gardens. Because Montana has a short growing season, sites of this type are not usually found in this state, and this ACEC represents the western-most findings of the middle Missouri tradition of agriculture.

Howrey Island

The Howrey Island ACEC, located in Treasure County, is one of the few BLM-administered islands in the Yellowstone River. White-tailed deer, ring-necked pheasants, numerous furbearers, and various non-game species are among the variety of wildlife inhabiting the island. An active bald eagle nest, which has successfully fledged young birds for a number of years, is also present. This ACEC is also nesting and brood-rearing habitat for Canada geese and other waterfowl species. Howrey Island is designated a watchable wildlife area and contains a self-guided nature trail for public use.

Jordan Bison Kill

The Jordan Bison Kill ACEC, located in Garfield County, is a 2,000-year-old bison jump, a rarity in the planning area. A sandstone cliff forms the main part of the kill site, and a nearby prehistoric campsite is associated with the jump. According to results of carbon dating, the campsite was used at least twice.

Piping Plover

The Piping Plover ACEC is located in Sheridan County. The piping plover is a threatened bird species associated with saline wetlands, typical of northeastern Montana. One parcel of BLM-administered land in Sheridan County, bordering a saline wetland near the town of Westby, is known to contain nesting piping plovers.

Powder River Depot

The Powder River Depot (site of the Powder River Depot ACEC), located in Prairie County, was the main supply depot for the armies that pursued the fleeing Sioux and Cheyenne Tribes throughout the summer of 1876 (during the Sioux War). This area contains a wealth of archeological information regarding the encampment and everyday life of the soldiers. The Powder River Depot was the location of General Terry's supply depot that supplied General Custer's troops before they left for the Battle of Little Bighorn. Left behind were three infantry companies, the 7th Cavalry band, personnel lacking proper equipment or suitable mounts, some civilian personnel, and wagons used in the march from Fort Lincoln. As many as 3,000 soldiers camped at the depot during the peak of the occupation.

Reynolds Battlefield

The Reynolds Battlefield ACEC, one of twelve battlefields in the region and the site of the first major battle of the Sioux War of 1876, is located in Powder River County. The Big Horn Expedition, under the command of General Crook, left Fort Fetterman, Wyoming, in mid-February and endured almost continual harsh winter weather with sub-zero temperatures. Marching north up the Powder River drainage, they crossed into Montana near Decker and proceeded down the Tongue River to Hanging Woman Creek. There Colonel Joseph J. Reynolds, with six companies of the 2nd and 3rd Cavalry, attacked the only village they found, which was located east on the Powder River. The attack began at dawn on March 17, 1876. In the early morning battle, the troops captured the village and some 800 horses and burned all of the camp tepees, although most of the inhabitants were able to escape. The village retaliated by firing down into the army positions from a high bluff to the west, and the troops withdrew under heavy fire. Their hasty withdrawal, ordered by Reynolds, left four dead soldiers in the field. Later that night, the village recaptured their horse herd. General Crook, enraged by these events, ordered Reynolds court-martialed. Compounding the defeat, the village was not, in fact, Sitting Bull's Sioux camp, as originally thought, but a Cheyenne camp on the way back to the reservation. This unprovoked attack on a peaceable camp turned the Cheyenne against the United States government, and they soon sided with the Sioux and participated in subsequent phases of the war.

Sand Arroyo

The geologic formations and associated fossils of the Sand Arroyo ACEC, located in McCone County, are a rare example of a continuous record of the end of the dinosaur age, the close of the Cretaceous Period, and the subsequent beginning of the age of the mammals at the start of the Tertiary Period. This area preserves a quality

record of this period and is globally rare. The focus of past field studies, the area has produced fossils for display and research because the necessary combination of bedrock exposure of the proper age and quality preservation of fossils provides research and collecting opportunities rare for this geological period.

Seline

The Seline ACEC, located in Dawson County, contains a 3,000-year-old site representing the trap method of bison killing (in which bison were herded up a narrowing or steep-ended draw before being killed with spears or arrows). The trap method served to slow and concentrate the bison, making them easier prey for the hunters.

Smoky Butte

The Smoky Butte ACEC, located in Garfield County, a landmark feature that guided early travelers to the area, is legally inaccessible. The rocks present at Smoky Butte contain rare minerals including armalcolite (a mineral found in samples of rock from the moon) and davanite, a recently described alkali titanosilicate mineral also found in Siberia) and which was discovered in Smoky Butte lamproite by Wagner and Velde (1986). Matson (1958) noted that one of the most striking features of the intrusive rock complex is their high potassium and titanium content and similarity to rocks found at West Kimberly, Australia, and the Leucite Hills of Wyoming.

The area was the subject of research by American, Canadian, and French scientists, and it was the location of a special field trip of the 28th International Geological Congress studying the Montana High Potassium Igneous Province in July 1989. Information from this area has been useful in drawing conclusions and advancing theories regarding the origin of the rocks as well as the composition and geotectonics of the earth's mantle.

BACK COUNTRY BYWAYS

The 105-mile Big Sky Back Country Byway runs through Prairie, McCone, and Roosevelt counties (Map 39). The Back Country Byway was designated in 2000 to provide opportunity for local communities, provide economic relief, and link the two major rivers in the Lewis and Clark Expedition, the Yellowstone and the Missouri. This route also runs along a homesteader's route called the RY-Trail, which linked Regina, Canada, with Yellowstone National Park. There are three kiosk locations along the Big Sky Back Country Byway in the rural towns of Terry, Circle, and Wolf Point. A fourth interpretive kiosk is located adjacent to State Highway 13, on the southeast side of the old historic bridge near Wolf Point. Historical and cultural resources, fishing opportunities, wildlife viewing, moss agate rock collecting, big game hunting, and rich history associated with the First Nations People are highlights of the byway.

NATIONAL TRAILS

LEWIS AND CLARK NATIONAL HISTORIC TRAIL

The Lewis and Clark National Historic Trail was designated in 1978 in recognition of the historic expedition by Lewis and Clark from 1804 to 1806. A portion of the Yellowstone River along the Lewis and Clark National Historic Trail is the route traveled by William Clark in July of 1806, during the expedition's return trip. This area contains approximately 16,000 acres of BLM-administered surface and approximately 23,500 acres of federal minerals (Map 16).

The nature and purpose of this national historic trail is the identification and protection of the historic route and the historic remnants and artifacts for public use and enjoyment. A National Historic Trail is managed to recognize the nationally significant resources, qualities, values, and associated settings of the areas through which such trails may pass, including the primary use or uses of the trail. Individual sections or segments of the trail and established management corridor may contain unique features or landforms, and variable resources, qualities, values, or associated settings.

The BLM manages the portion of the Lewis and Clark National Historic Trail within the planning area in a manner that is consistent with the purposes and provisions of the National Trails System Act (PL 90-453, 1968,

as amended by PL 96-625, 1978). The NPS *Lewis and Clark National Historic Trail Comprehensive Management Plan* (1982) outlines management objectives, practices, and responsibilities and emphasizes partnerships in trail administration. Scenic and cultural values will be protected on BLM-administered land along this historic trail. The 6280 Manual, Management of National Scenic and Historic Trails and Trails Under Study or Recommended as Suitable for Congressional Designation, further outlines BLM's responsibilities.

Four recreation sites are also located within the Lewis and Clark National Historic Trail: Howrey Island Recreation Area, Matthews Recreation Site, Calypso SRMA, and the Powder River Depot SRMA. The Lewis and Clark National Historic Trail lies within the Lewis and Clark Trail SRMA that was originally established in the *Big Dry Resource Area Management Plan Record of Decision in April of 1996.*

WILD AND SCENIC RIVERS

As required under the Wild and Scenic Rivers Act (16 U.S.C. 1271 et seq.), in 2008, rivers in the planning area were inventoried and studied for values that would contribute to their consideration as wild and scenic rivers. However, no rivers or river segments were found to contain one or more outstandingly remarkable values along their BLM-administered segments, which eliminated these areas from consideration for designation.

See the *Special Designation Areas Appendix* for detailed information about the wild and scenic river evaluation process used in the planning area.

WILDERNESS

There are no designated wilderness areas within the planning area.

WILDERNESS STUDY AREAS

There are five WSAs with a total of approximately 83,160 acres of BLM-administered lands (Table 3-37 and Map 39). Four of these WSAs were studied under the authority of Section 603, and one was studied under Section 202. The WSAs are managed as a limited area for OHV uses, which allow vehicle use only on the inventoried roads and ways that existed at the time of inventory.

In addition to the lands above, the BLM acquired three privately owned sections of land within the Terry Badlands WSA. These lands were inholdings at the time the WSA was studied for wilderness potential and changed the total area recommendations. This acquisition contained 1,960 acres of public land located 3 miles northwest of Terry, Montana, in Prairie County. These lands would be managed the same as like adjacent lands under the authority of 43 CFR 2200.0-6(f) and (g).

TABLE 3-37.
WILDERNESS STUDY AREAS MANAGED BY THE MILES CITY FIELD OFFICE

WSA Name	WSA Number	FLPMA Section	Total Acres	Acres Recommended for Wilderness	Acres Recommended for Non-wilderness
Billy Creek	MT-024-633	202	**3,450**	0	3,450
Bridge Coulee	MT-024-675	603	**5,900**	0	5,900
Musselshell Breaks	MT-024-677	603	**8,650**	0	8,650
Seven Blackfoot	MT-024-657C	603	**20,250**	5,710	14,540
Terry Badlands	MT-024-684	603	**44,910**	33,024	11,886
Total			**83,160**	**38,734 (40% of total WSA acres)**	**44,426 (60% of total WSA acres)**

The option to either designate lands as wilderness or release them from further consideration as wilderness rests with Congress. BLM is responsible for ensuring wilderness values on those lands are in the same or better condition, until Congress makes a final determination as to the suitability of those lands for inclusion in the National Wilderness Preservation System. With the enactment of Public Law 113-291, the National Defense Authorization Act of 2015 (NDAA), on December 19, 2014, Zook Creek WSA in Rosebud County, 8,438 acres; and Buffalo Creek WSA in Powder River County, 5,650 acres were released from being managed as WSAs. NDAA also stated both of these areas are to be managed in accordance with the Powder River Resource Area Resource Management Plan, as amended. Also in reference to WSAs, the NDAA stated that within 5 years from the date of the act the BLM to complete a report for Congress that describes the oil and gas potential for the Bridge Coulee and Musselshell Breaks WSAs.

SOCIAL AND ECONOMIC

SOCIAL CONDITIONS

This section discusses the social conditions in the planning area, which includes 17 counties in eastern Montana. The counties with the most amount of BLM-administered surface include Carter (503,790 acres), Garfield (493,491 acres), Prairie (447,462 acres), Custer (332,459), Powder River (255,875 acres), Rosebud (230,056 acres), McCone (200,808), and Fallon (115,261 acres). All other counties have less than 100,000 acres of BLM-administered surface lands. All of these counties have at least 600,000 acres of BLM-administered mineral acres except Big Horn, Daniels, Fallon, Roosevelt, Treasure, Valley, and Wibaux counties. Some of these counties (Big Horn, Carter, Garfield, Powder River, Prairie, Richland, and Sheridan) have more than 50 percent of their county acreage in BLM-administered minerals. Table 1-1 provides the specific percentages of BLM surface lands and mineral acres for each of the planning area counties. Oil-related leasing and development occurs primarily in Dawson, Fallon, Powder River, Prairie, Richland, and Wibaux counties, and gas-related leasing and development occurs in Big Horn, Carter, Custer, Fallon, Richland, and Wibaux counties. Coal development occurs in Big Horn, Richland, and Rosebud counties. BLM-administered grazing occurs throughout the planning area and recreation lands are concentrated in the areas containing the majority of the public surface acres.

Social Trends and Attitudes

This section focuses on social trends and attitudes that affect BLM land management. This information is important to decision makers because the trends and attitudes can affect relationships between the agency and its constituents, the ability to successfully implement plans, and the potential impacts to communities (both communities in the geographical sense and communities of interest).

Changes in the management of BLM-administered lands are just one aspect of a broader debate in environmental and resource management occurring locally, nationally, and globally. Commodity, amenity, environmental quality, ecological recreation, and spiritual are all social land and natural resource values. While the emphasis on the commodity value of public lands has been prevalent in the past, a study examining public attitudes toward ecosystem management in the United States found “generally favorable attitudes toward ecosystem management [defined as maintaining and ensuring sustainability] among the general public (Bengston, Xu, and Fan 2001).”

In the rural West, in places where land use has been relatively unrestricted, some individuals and groups have expressed concern regarding the control and management of BLM-administered lands. People with these concerns feel that government officials and environmental advocacy groups that do not have a true understanding of the lands or local residents who depend upon these lands for income and recreation drive change in BLM land management. Of particular concern is the loss of current land uses such as livestock grazing and OHV use. People with these concerns seek to balance what they consider environmental extremism with economic and human concerns, and they may feel that local elected officials are more closely in touch on a daily basis and better equipped to make decisions about BLM-administered lands than federal managers located elsewhere.

The MCFO's area of influence contains a significant amount of federal ownership. The counties in the planning area contain portions of the Custer National Forest, the Charles M. Russell National Wildlife Refuge, and other small, federally managed areas. Because some members of the public do not readily differentiate between the various federal land management agencies, activities by other federal agencies may affect perceptions about the BLM. General attitudes towards the federal government, in some cases unrelated to specific BLM activities, may also influence attitudes towards the BLM.

The major trends affecting BLM's land management of the MCFO area are described below.

- The increasing popularity of BLM-administered land for recreation. A comprehensive report on recreation by Cordell et al. (1999) indicate that demand in the Rocky Mountain West for recreation activities will increase substantially by the year 2020, with non-consumptive wildlife activities, sightseeing, and visiting historic places increasing the most.

- Differing views on how BLM resources and resource uses contribute to people's quality of life. Conflicts surrounding BLM resources, resource uses, and management often stem from how individuals/groups prioritize their values—one may prioritize his/her value of recreational opportunities over another person's aesthetic value of an area. As more people appreciate BLM resources and engage in resource uses, there is the likelihood of increased conflict due to people wanting different opportunities associated with BLM resources.

- Aging population is another trend occurring in the nation and Montana; in 2010, 20 percent of the population in the planning area was 65 or older, compared to a statewide figure of 15 percent. For the state as a whole, the percentage of population 65 or older is expected to increase to 25 percent by 2025. The percentage of people 65 or older is actually increasing more rapidly in states like Montana because young people are more likely to leave for advanced education, military service, and employment opportunities unavailable locally.

Planning Area Demographics and Quality of Life

Population and demographic changes are instrumental to understanding a community, since they may drive many of the other community changes brought upon by federal resource management actions. Demographic changes such as large age cohort sizes or residential mobility can affect the local institutions and social context (Burdge 1983; Finsterbusch 1980). A community with an older cohort age (say 65 and older) may have different community services available to meet the 'senior' market. Population changes due to in- or out-migration can affect local community ties and social relationships. A federal management that may increase local communities' populations or demographics can have impacts that ripple throughout the social and economic contexts.

In 2013, the population estimate for the planning area was 91,195 residents which is an increase of over 5,000 residents from the 2005 estimate of 85,930 residents (Table 3-38). County population estimates for 2013 ranged from a high of 13,042 residents in Big Horn County to a low of 700 in Treasure County. The following eight counties had fewer than 2,000 residents in 2013: Carter, Daniels, Garfield, McCone, Powder River, Prairie, Treasure, and Wibaux. Only Big Horn, Custer, Richland, and Roosevelt counties had 2013 population estimates over 10,000 residents. While the population for the planning area as a whole increased, Big Horn, Carter, Daniels, and McCone counties had fewer residents in 2013 than in 2005. In three of the four counties the decline in residents occurred in the 2005 to 2010 timeframe with a positive annual increase in population from 2010 to 2013. McCone County has seen a declining population during both the 2005 to 2010 timeframe and the 2010 to 2013 timeframe.

Population changes occur by natural increases and decreases (births and deaths) and in- and out-migration. Net out-migration was a major catalyst in the declining populations across the planning area counties from 2000 to 2009 (Table 3-38). Natural decreases also occurred but to a smaller degree than out-migration. Only Big Horn, Fallon, Garfield, Roosevelt, and Rosebud counties saw natural increases during that time. Both McCone and Treasure counties saw a decrease in populations from 2010 to 2013 with out-migration being the major cause.

TABLE 3-38

POPULATION AND DEMOGRAPHIC CHARACTERISTICS IN THE PLANNING AREA

	Population			Total Natural Increase	Total Migration	Total Natural Increase	Total Migration	Median Age	
County	2005 Estimate[1]	2010 Census[2]	2013 Estimate[2]	2000-2009[3]		2010-2013[4]		2000 Census[5]	2013 Estimate[6]
Big Horn	13149	12865	13042	1,475	-1,077	427	-242	29.8	30.2
Carter	1320	1160	1174	-64	-93	-3	16	41.8	51.3
Custer	11267	11699	11951	-1	-446	36	218	39.3	41.9
Daniels	1836	1751	1791	-106	-201	-8	43	47	49.7
Dawson	8688	8966	9445	-114	-342	44	453	41	40.8
Fallon	2717	2890	3079	31	-134	87	109	41.1	39.6
Garfield	1199	1206	1290	39	-141	12	59	41.6	46.1
McCone	1805	1734	1709	-28	-324	-10	-16	42.4	49.6
Powder River	1705	1743	1748	-64	-121	-38	45	42.1	50.6
Prairie	1105	1179	1179	-79	-10	-10	13	48.9	53.6
Richland	9096	9746	11214	-2	-307	159	1,315	39.2	37.9
Roosevelt	10524	10425	11125	911	-1,189	292	390	32.3	31.3
Rosebud	9212	9233	9329	915	-1,004	298	-202	34.5	36.5
Sheridan	3524	3384	3668	-343	-511	-56	335	45.1	47.3
Treasure	689	718	700	-10	-240	0	-16	41.8	53.7
Valley	7143	7369	7630	-91	-792	19	265	41.7	45.5
Wibaux	951	1017	1121	-105	-65	-17	118	42.3	48.8
Planning Area Total	85930	87085	91195	--	--	--	--	41.7	46.1
State of Montana	935670	989415	1015165	31,184	42,980	10,260	15,200	37.5	39.9

Source: 1U.S. Census Bureau, Population Division 2006; 2U.S. Census Bureau, Population Division 2014a; 3U.S. Census Bureau, Population Division 2010; 4U.S. Census Bureau, Population Division 2014b; 5 U.S. Census Bureau, Population Division 2000; 6U.S. Census Bureau, Population Division 2014c.

During that same time natural increases were the main factor for population growth for Big Horn and Rosebud counties. In-migration was the dominant factor for population growth in the other counties with Richland County seeing a net of 1,315 in-migrants during the 2010 to 2013 timeframe.

Based upon the 2010 Census data (U.S. Census Bureau 2010) the largest community is Miles City in Custer County, located in the southern part of the planning area. Miles City, with a 2010 population of 8,123, was the only community in the entire planning area with a population greater than 5,000. Between 2000 and 2010, Miles City's population declined 2.4 percent. Other communities in the planning area with 2010 populations greater than 1,000 include Sidney in Richland County (with a population of 4,843), Glendive in Dawson County (4,628), Hardin in Big Horn County (3,532), Glasgow in Valley County (2,870), Wolf Point in Roosevelt County (2,557), Colstrip in Rosebud County (2,377), Forsyth in Rosebud County (1,865), Plentywood in Sheridan County (1,638), and Baker in Fallon County (1,640). Some of the communities in the planning area, such as Sidney (Richland County) and Glendive (Dawson County) are currently experiencing an influx of population related to the oil and gas development in western North Dakota. While increases in business are bringing money into these communities, there are associated social problems, such as increased traffic and crime and increased competition for housing and public services.

The median age of residents in Montana in 2013 was 39.9 years old, which is an increase of 2.4 years over the 2000 Census median age (Table 3-38). Five counties saw the same or a younger median age in 2013 than in 2000-Big Horn, Dawson, Fallon, Richland, and Roosevelt counties. Treasure County saw the largest increase, almost 12 years, in median age from 2000 to 2013. A majority of the planning area counties had higher median ages than Montana with only Big Horn, Dawson, Fallon, Richland, Roosevelt, and Rosebud counties each having a lower or similar median age than Montana in 2013. Counties with median ages above 50 years old in 2013 include Carter, Powder River, Prairie, and Treasure counties. Age structures in rural communities are often influenced by in- and out-migration for education and/or employment. Large or small age cohorts can impact housing needs, local schools, labor force and other community facets. BLM actions, such as authorizing energy development projects that may bring in a large workforce in which workers tend to be in the same age cohort, can contribute these types of changes.

Quality of Life (QOL) is an integral aspect of understanding a community and its people. QOL is what brings pleasure and happiness to life-it can include "feeling a part of the community where you live; knowing where you stand in relationship to other people; having a sense that you and people in your community have control over the decisions that affect your future;….living without undue fear of crime or personal attack…" (Branch et al. 1982). The components of QOL can differ amongst individuals, however generally many components relate to income, employment and job satisfaction, affordable housing, health, food, culture, leisure, and amenities. Community factors such as the range of community services and community structures provided such as: utilities and transportation; emergency services; health care programs; governmental organization and management; education system; recreational opportunities; land use/land development; community demographics; and economic viability an also influence an individual's QOL.

Impacts to QOL can be perceived differently by individuals in part due to what they value. Additionally, federal resource management decisions can be perceived to impact QOL differently. Understanding the current context of QOL can help federal resource management agencies identify affected individuals and groups (stakeholders), potential key issues, areas of agreement/disagreement for possible management actions, and community services that may be impacted.

Affected Groups and Individuals (Stakeholders)

Describing the planning area quality of life includes understanding the views and values held by individuals or groups that are affected by or interested in natural resource issues (stakeholders). This section's discussion attempts to provide a broad overview of the range and variety of views and values held by those interested in BLM management. Stakeholders base their views towards BLM resources, resource uses, and management actions on the values they hold. Oftentimes these values are put forth as an individual's or group's focus of interest, the basis for the agenda they bring forth, and/or determines what an individual or group finds valuable in contributing to their quality of life.

- There is considerable complexity involved in fully understanding the views and values of stakeholders. This is, in part, due to the fact that individuals and groups can hold multiple values, and at times those values could be in conflict with each other and it is up to that individual or group to prioritize those values in order to address the issue at hand. One way to understand possible views and values towards BLM resources, resource uses, and management actions is to identify a range of values that can be held by an individual or group. There are several ways one can discuss the range of possible value typologies, including work done by Brown and Reed (2000). Brown and Reed (2000) developed a list of thirteen value typologies as a way to understand stakeholder values toward natural resources. The adaptation of Brown and Reed's list presented below highlights the variety of values a person may hold towards BLM resources, resource uses, and management. Aesthetic-I value the BLM resources and uses because I enjoy the forest scenery, sights, sounds, smells, etc.
- Biological diversity-I value the BLM resources because it provides a variety of fish, wildlife, plant life, etc.
- Life-sustaining-I value BLM resources because they help produce, preserve, clean and renew air, soil, and water.
- Recreation-I value BLM resources and resource uses because it provides a place for outdoor recreation activities.
- Moral/ethical-I value BLM resources in and of themselves for their existence, no matter what I or others think about those resources.
- Historical/cultural-I value BLM resources and resource uses because they have places and things of natural and human history that matter to me, others or the Nation and/or I value BLM resources and resource uses because it is a place for me to continue and pass down the wisdom and knowledge, traditions, and way of life of my ancestors.
- Therapeutic- I value BLM resources and resource uses because it makes me feel physically and/or mentally better.
- Scientific/learning-I value BLM resources because we can learn about the environment through scientific observation or experimentation.
- Spiritual-I value BLM resources because they provide a sacred, religious, or spiritually special place to me or because I feel reverence and respect for nature there.
- Economic-I value BLM resources and resource uses because they provide timber, fisheries, minerals, grazing, or tourism opportunities that provide economic benefit.
- Subsistence-I value BLM resources because they provide necessary food and supplies to sustain my life.
- Future-I value BLM resources because they allow future generations to know and experience these resources.

While the above list of value typologies is not exhaustive, it does provide a glimpse at the variety of values individuals or groups may hold towards BLM resources and resource uses. All of these are valid values and many of us hold several to all of them. Conflicts surrounding BLM resources, resource uses, and management often stem from how individuals/groups prioritize their values—one may prioritize his/her value of recreational opportunities over his/her historical value of an area. Additionally, these are broad and somewhat simplistic value typologies and there can be conflicts within a value typology such as conflict between people's values of different recreational opportunities. What people value and how they prioritize their values helps to determine their quality of life and if the values they prioritize exist in the surrounding area. Quality of life is often associated with communities, community infrastructure, relationships among residents, educational opportunities, and the like. Additionally, quality of life can be associated with the amount and quality of available resources such as recreation opportunities and resolution of problems related to resource activities.

As a way to discuss the variety of values that relate to the Miles City BLM resources, resource uses, and management, we have grouped similar value priorities and categorized these as affected groups and individuals (stakeholders). These are generalized groupings and an actual individual or group likely falls into multiple groups. Moreover, one should not consider these stakeholder groups as homogenous. In other words, even within the categorized stakeholder groups differences in values may still occur. The categorized stakeholder groups, however, provide a useful way to discuss similar value priorities and set up a way to discuss potential impacts to those values.

Based upon local understanding of the views and values associated with Miles City BLM resources, resource uses, and management as well as based upon the comments received during this planning process the following stakeholder groups were categorized: groups and individuals that prioritize ranching, ranching livelihood and agricultural lifestyle; groups and individuals that prioritize recreational opportunities they value or participate in, groups and individuals who prioritize resource protection, groups and individuals who prioritize resource use, groups and individuals that prioritize local communities and local community benefits, and Native Americans. Again, it should be noted that these groups are not mutually exclusive since groups and individuals have multiple values.

Groups and Individuals that Prioritize Ranching, Ranching Livelihood and Agricultural Lifestyle

Ranching is an important part of the history, culture, and economy of the study area. In 2012, there were 25.5 million acres in6,744 farms and ranches in the planning area. This figure indicates 24 percent of the ranches and 42 percent of the lands in farms and ranches in Montana are located in the planning area (NASS 2014). Many livestock operators in the planning area hold livestock grazing permits on public lands which provides considerably cheaper forage ($1.35 per AUM in 2014) compared to private grazing fees ($21 per AUM in 2013 (NASS 2014)). Ranchers face many challenges today including changes in federal regulations, economic issues, and changing land use. In the last couple of years, there has been a decline in the prices farmers and ranchers receive for commodities such as wheat and alfalfa (NASS, 2014). This price reduction can cause economic concerns for ranchers and farmers in planning area counties that produce these commodities. Producers in Sheridan, Valley, Garfield, McCone, and Richland counties are likely more impacted by these price reductions given that these counties ranked high in the amount of production across all Montana counties (NASS 2014). Planning area counties with high cattle inventories, Big Horn, Powder River, and Rosebud all ranked in the top 10 in 2013 for all cattle and calves, have seen some variation in the value per head of livestock, but the 2014 value of $1,430 is the highest seen since 2004 (NASS 2014). While the value per head of all sheep has decreased since 2012, the 2014 value of $184 is higher than seen in years 2004-2011 (NASS 2014).

Ranchers and permittees may face increasingly stressful social situations as they try to balance their traditional lifestyles with demands from government agencies and other public land users such as recreationists. Changes that are occurring in the planning area include an increase in land sales for recreation purposes, primarily hunting, which can result in ranches being divided into smaller units. Often the new owners lease the ranch (including BLM-administered lands) for grazing and use the land for recreation. In some cases, particularly in land with scenic values, the recreational value of property has become nearly as important as the agricultural values. Some ranchers are diversifying their operations by guiding hunters or other recreationists or making land available to outfitters. The tradition of ranching as a multi-generational livelihood is also changing with the selling of family ranches for subdivision, or when an estate is settled and sold instead of continued operation by the next generation (Fallon County 2012). Many of the planning area counties emphasize the importance of agriculture to their economy and culture in their county plans and growth policies (for examples see Custer County 2013; Dawson County 2013; Fallon County 2012; and Powder River 2012).

Concerns about livestock grazing include potential conflicts between recreation users and grazing leaseholders, increasing or maintaining AUMs on grazing allotments, maintaining AUMs to accommodate other uses, prairie dog management, invasive weed species control, the continued use of OHVs to monitor leases, and suggestions that the BLM manage with greater flexibility from year to year and place to place. The importance of the use of federal land to graze livestock as an essential part of the local way of life and heritage was also emphasized and many commenters indicated that they felt that local comments should carry more weight than those from out of state.

Groups and Individuals that Prioritize Recreational Opportunities

Recreation is often an important component influencing a person's quality of life, and this seems especially true in Montana. According to University of Montana research, Montanans take more leisure trips than the United States average (MFWP 2008). As discussed in the recreation section, the planning area provides a range of settings and opportunities for a diverse array of recreation experiences and activities while also balancing other uses and resource protection needs. The substantial recreational opportunities for fishing, hunting, hiking, horseback riding, OHV use, and sightseeing are important elements of the overall quality of life for planning

area residents and visitors.

Recreationists represent very diverse groups of people, and changes in recreation management can affect people who engage in the various activities differently based on need and preference. Recreationists tend to organize into interest groups; most recreational activities have at least one organization that advocates for their particular activity. In addition to recreation use by local residents, some destinations in the area attract visitors from other areas of the United States for fishing, hunting, and other recreational activities.

The *Montana Statewide Comprehensive Outdoor Recreation Plan* outlined key issues based on statewide surveys and other research (MFWP 2008). The following are some of the key issues relevant to BLM-administered lands in the planning area:

- a need for continued access to, and maintenance of, rural and backcountry trails and use areas for hiking, biking, skiing, and equine and motorized (OHV, snowmobile) recreation;
- a need for increased miles and maintenance of urban and rural trails and access for water-based recreation; and
- insufficient quality and quantity of recreation facilities for youth.

Outfitters and guides use recreational opportunities in the study area for economic gain. Some outfitters and guides are ranchers or farmers who use recreation as a means to achieve economic diversification. Others operate full-time or seasonal outfitter businesses and employ some local residents as guides, while still others are permanent full-time independent guides who have their own clients, both local and non-local. Approximately 48 outfitters and guides are permitted by the MCFO. Most of the BLM permits are for hunting, campouts, and wagon trains, but outfitters and guides can request permits for a variety of other uses. A fee is assessed for commercial permits.

Concerns from recreationists include conflicts between ranchers and recreationists, conflicts among recreationists (particularly motorized and non-motorized users), greater enforcement of OHV use, access to isolated parcels of BLM-administered land, and designation of areas for motorized and non-motorized use.

Groups and Individuals Who Prioritize Resource Protection

Various individuals and groups at the local, regional, and national levels are interested in the way BLM manages public lands. Many of these concerns regard wildlife, water quality, and visual quality. They value BLM-administered land for wildlife, recreation, education, scenic qualities, wilderness, and open space, among other reasons. Specific concerns include the potential impacts from energy development, the proliferation of pipelines without consideration of planned corridors, sage-grouse and other bird species populations and habitat protection, black-footed ferret reintroduction, preservation of water quantity and quality, and unregulated OHV use. Generally, the use of conservation easements for resource protection is also supported.

Groups and Individuals Who Prioritize Resource Use

Individuals and groups, including many local residents, are concerned about limitations on the availability of public lands for commercial uses, such as livestock grazing and mineral or energy development. They indicate that the public lands have to be managed to be as productive as possible and the survival of local economies and local communities depend upon these industries (BLM 2003l). Comments from oil and gas companies indicate concern for negative or excessive rules that would hinder development and lead to limited production and revenues, an interest in the use of adaptive management, and the assessment of mitigation measures during planning.

Groups and Individuals that Prioritize Local Communities and Community Benefits

The planning area population is mainly rural, with many small towns and communities and strong ties to the land. Small rural communities can be tied to BLM-administered and public lands in a variety of ways. Local businesses and governments depend upon BLM employees to support businesses and public services, while use of public lands for recreation activities, livestock grazing, minerals or energy development, and other activities

can provide economic and leisure-time opportunities.

Many of the planning area counties have developed growth policies which highlight what counties and community residents appreciate and desire to either maintain or achieve in the future. Although the growth policies likely do not represent all residents' views and values, the policies do provide an indication of what these communities are discussing and what they are hoping to achieve. These growth policies tend to emphasize the area's strong agricultural traditions and its importance to local economies and balancing agriculture with energy development, recreational opportunities, and diversifying their economies. For example, the Powder River County Growth Policy (2012) has the goal of "[Planning] for compatible land uses throughout the County while preserving multiple uses for existing and future agricultural, ranching, natural resource extraction, forestry, and recreational land" (p.40). Fallon County's growth policy also echoes this by including goals such as "protect agricultural land, which is a valuable county resource"; "promote a diversified local economy that is not overly reliant on the energy sector"; and " preserve native vegetation and wildlife habitat" (Fallon County 2013). While supporting natural resource development and agriculture there is also the desire to diversify the economy in part to "mitigate negative impacts of 'boom and bust'" cycles (Powder River County 2012).

Many of the counties value natural resource development such as oil and gas development for the increased tax revenue, increased job opportunities, and higher incomes (for example see Powder River County 2012; Prairie County 2006; Sheridan County 2013; and Richland County 2007). However many of these same counties have experienced the 'boom and bust' cycle of energy development before and would like to plan for the down cycle of development and ensure that more sustainable economic growth and opportunities exist. In general, the planning area counties would like to see natural resource development done in a more sustainable and environmentally responsible manner so natural resources such as clean air and water can be maintained while also allowing opportunities for economic growth (for example see Custer County 2013 and Sheridan County 2013).

Promoting tourism in the planning area is seen as one way to diversify, stabilize and increase the local economies. Powder River County already sees the value of tourism especially related to hunting and recognizes there are opportunities to attract more visitors through historical and cultural tourism (Powder River County 2012). A concern expressed in the Prairie County growth policy was about potential restrictions on any of the multiple uses, including recreation, on federal and state lands could affect economic stability and growth (Prairie County 2006).

Sustaining stable populations is also a concern often discussed in the planning area counties' growth policies. As noted earlier, some of the counties are seeing declining and aging populations. Providing business and job opportunities may attract new residents, but the desire is for population to grow at a rate that local government services and infrastructure can support (for example see Custer County 2012; Fallon County 2012; Prairie County 2006; Richland County 2007). There are currently concerns about a lack of adequate and affordable housing across the planning area counties for residents and a need to also have sufficient housing opportunities for the energy sector temporary workforce (for example see Fallon County 2012 and Sheridan County 2013). Additionally, counties expressed the need for increased emergency services (EMS) capacity especially with increased energy development. Two goals in Dawson County's growth policy (2013) reflect what many of the counties emphasized, which is to "establish land use patterns which accommodate growth, preserve the identity and character of existing communities and minimize conflicts with agriculture and existing businesses and industries" and to "protect and conserve the natural resources, clean air and water, and environment by promoting land use patterns which balance economic benefits and environmental stewardship and preserve the quality of life for residents…" (p. 95, 101).

Local community concerns received during scoping included payment in lieu of taxes (PILT), management of invasive weed species and fires, continued use of OHVs, development to support local communities, and emphasis on local comments versus out-of-state comments.

American Indians

Three American Indian Reservations are located in or near the planning area. The Northern Cheyenne

Reservation is located in the southeastern part of the planning area, in Big Horn and Rosebud counties. The Crow Reservation is adjacent to the Northern Cheyenne Reservation and lies outside the planning area. The Fort Peck Reservation, which is home to the Assiniboine and Sioux Tribes, is located in the northern part of the planning area. In addition, the Turtle Mountain Reservation of North Dakota has scattered land in Sheridan and Roosevelt counties. Other tribes have also shown an interest in the area (see *Tribal Interests*). The following types of traditional contemporary religious sites may be in the planning area: vision quest sites, rock art sites, burials, habitation sites, and dance grounds. Hunting and plant gathering (for religious or ceremonial purposes) also occur in the planning area. Concerns received from various tribes include various methods of protection and access to cultural resources, concerns with the effects from oil and gas leasing, sage-grouse declines, overgrazing, erosion, and other resource issues.

Tribal Interests

BLM coordination or consultation with American Indians, as it pertains to tribal interests, treaty rights and trust responsibilities, is conducted in accordance with the following direction:

- BLM Manual Handbook H-8120-1, *Guidelines for Conducting Tribal Consultation* (transmitted December 3, 2004);
- Executive Order No. 13084 , Consultation and Coordination with Indian Tribal Governments (May 14, 1998);
- *Government-to-Government Relations with Native American Tribal Governments* (Memorandum signed by President Clinton on April 29, 1994); and
- Order No. 3175, Departmental Responsibilities for Indian Trust Resources (Section 2 of Reorganization Plan No. 3 of 1950 – 64 Stat. 1262; November 8, 1993).

Treaties are negotiated contracts made pursuant to the Constitution of the United States and are considered the "supreme law of the land." They take precedence over any conflicting state laws because of the supremacy clause of the Constitution (United States Constitution, Art. VI, Clause 2). Treaty rights are not gifts or grants from the United States, but bargained-for concessions. These rights are grants-of-rights from the tribes, rather than to the tribes. The reciprocal obligations assumed by the federal government and American Indian Tribes constitute the chief source of present-day federal Indian law.

The United States and represented agencies, including the BLM, have a special trust relationship with American Indian Tribes because of these treaties. As a federal land management agency, the BLM has the responsibility to identify and consider potential impacts of BLM plans, projects, programs, or activities on Indian trust resources. When planning any proposed project or action, the BLM must ensure that all anticipated effects to Indian trust resources are addressed in the planning, decision, and operational documents prepared for each project. The BLM also has the responsibility to ensure that meaningful consultation and coordination concerning tribal treaty rights and trust resources are conducted on a government-to-government basis with federally recognized tribes.

American Indians inhabited eastern Montana, including the lands now managed by the MCFO, for thousands of years prior to European contact. They hunted, fished, and gathered plants on lands within the planning area since ancient times. These practices continue today.

The lands managed by the MCFO are within the historical or traditional culture use area of the following tribes:

- Fort Peck Tribes (Assiniboine and Sioux),
- Lower Brule Sioux Tribe,
- Turtle Mountain Band of Chippewa Indians,
- Crow Tribe,
- Northern Cheyenne Tribe,
- Oglala Sioux Tribe of the Pine Ridge Reservation,
- Standing Rock Sioux Tribe of the Standing Rock Reservation,
- Rosebud Sioux Tribe,
- Northern Arapaho Tribe,

- Eastern Shoshone Tribe,
- Cheyenne River Sioux Tribe,
- Blackfeet Tribe,
- Gros Ventre and Assiniboine Tribes of the Fort Belknap Reservation, and
- Chippewa-Cree Tribe of the Rocky Boy's Reservation.

The MCFO maintains a government-to-government relationship with tribal governments in the use and protection of cultural and natural resources on public lands. It is the responsibility of the BLM to consult with federally recognized tribes to ensure BLM's policies and actions do not affect traditional tribal activities, practices, or beliefs relating to particular locations on public lands.

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, states "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations…" (Executive Order 12989).

Minority populations as defined by Council on Environmental Quality (CEQ) guidance under the National Environmental Policy Act (CEQ 1997) include individuals in the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. A minority population is identified where "(a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater…" (CEQ 1997). Additionally, "[a] minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds" (CEQ 1997). Low-income populations are determined by the U.S. Census Bureau based upon poverty thresholds developed every year.

U.S. Census data is used to determine whether the populations residing in the study area constitute an "environmental justice population" through meeting either of the following criteria:

- At least one-half of the population is of minority or low-income status; or
- The percentage of population that is of minority or low-income status is at least 10 percentage points higher than for the entire State of Montana.

Data for the identification of low-income is from the U.S. Census Bureau, Small Area Income and Poverty Estimates (SAIPE). The SAIPE program produces yearly single year poverty estimates for states, counties, and school districts and is considered the most accurate for these geographic scales, especially for areas with populations of 65,000 or less (U.S. Census 2014e). Minority populations are identified using the U.S. Census Population Estimates program which provides estimates for the resident population by age, sex, race, and Hispanic origin at the national, state and county scales. Total minority population refers to that part of the total population which is not classified as Non-Hispanic White Only by the U.S. Census Bureau. By using this definition of minority population, the percentage is inclusive of Hispanics and multiple race categories and any other minority single race categories. This definition is most inclusive of populations that may be considered as a minority population under EO 12898. Estimates from SAIPE and the Population Estimates program are used in federal funding allocations.

For this planning effort the identification of environmental justice populations is conducted at the county level due to the large geographic area. Based on the criteria mentioned above, Table 3-39 indicates that Big Horn, Roosevelt, and Rosebud counties meet the criteria of having identified minority environmental justice populations. Big Horn and Roosevelt counties are also the two counties that meet the criteria for having identified poverty environmental justice populations. Overall, the planning area does have counties that meet the criteria for environmental populations and therefore outreach and collaborative efforts with these environmental populations were conducted.

ECONOMIC CONDITIONS

Employment and Specialization

The local economy that encompasses the MCFO is diverse and supports employment in 178 industrial sectors. These industries can be classified as being either Services or Non- services related. Employment in services related industries generally include jobs in the Utilities, Wholesale Trade, Retail Trade, Transportation & Warehousing Information, Finance & Insurance, Real Estate & Rental & Leasing, Professional, Scientific, & Tech., Mgmt. of Companies & Enterprises, Administrative & Support Services, Educational Services, Health Care & Social Assistance, Arts, Entertainment, & Recreation, Accommodation & Food Services, and Other Services sectors ,while Non-services related employment occurs in the Mining, Construction, Manufacturing, and Agriculture, Forestry, Fishing, and Hunting sectors.

Over the last two decades many parts of the United States have experienced substantial job growth in Service sector while opportunities for jobs in the Non-Service sector have declined. Although job growth is often perceived as a positive economic indicator, job growth may indicate declining economic opportunities when it is heavily concentrated in low-wage industries. Employment in certain Service industries, such as retail trade, agriculture, and social services, are generally characterized by lower wages, less tax revenue and increased demand for public assistance and social services programs (Zabin et. al 2004). On average, U.S. jobs in service related industries pay 21 percent less than non-service industries (U.S. Department of Labor 2013). Though services related employment is often associated with lower paying jobs, these employment opportunities often play an important role in increasing labor participation by minority or underserved populations. In general, service industries provide greater employment opportunities for women and minority groups than industries in the Non-service sector.

Between 1998 and 2011 the 17-county planning area added 3,136 new jobs to the local economy. Increased employment opportunities were attributable to job creation in both the Service (+1,549 jobs) and Non-Service (+1,587 jobs) sectors. Although nearly half of all new jobs were added in service industries, the Service sector's share of total regional employment has been declining. In 1998, employment in services accounted for 86% of total jobs, falling to just below 82% of total employment in 2011. During this time, local employment in Non-Service related industries grew by 54 percent from 2,920 jobs to 4,507 jobs (U.S. Department of Labor 2013). In 2012 a total of 11,852 jobs were filled in the planning area (IMPLAN 2012).

Diverse economies are generally more stable and offer greater number of opportunities for employment. Highly specialized economies (i.e. those that depend on a few industries for the bulk of employment and income) tend to be more prone to cyclical fluctuations and support more limited job opportunities. Assessing employment by industrial sector helps identify industries that are important to the local economy and those that could be affected by alternative management actions. Figure 3-11 shows local employment in different industry sectors as a share of total employment (IMPLAN 2012). In 2012 the Government (19%) and Agriculture, Forestry, Fishing, and Hunting (15%) sectors were the largest employers within the planning area. Although employment in these sectors is obtainable through a number of employers, a portion of employment in these sectors can directly be attributed to the MCFO. In addition to employing Government workers to administer and maintain these public lands, non-salary expenditures associated with administering individual resource programs supports employment opportunities in the goods and services sectors. Out of the 11, 852 jobs in the planning area 1,970 jobs or 3.2 percent of employment can be attributed to the BLM MCFO (IMPLAN 2012). The BLM MCFO contributed most to employment in the agriculture (and forestry, fishing, hunting) and the mining sectors within the planning area in 2012 (Figure 3-12). Overall in 2012, MCFO contributed to 2.8 percent of planning area income. MCFO contributed most to income related to the mining industry sector (7 percent).

Opportunities for outdoor recreation on BLM administered lands within the MCFO help bolster the local tourism and recreation industry and support employment opportunities in industries providing goods and services to recreationists. While employment associated with outdoor recreation cannot be measured in a single sector, tourism and outdoor recreation spending has been shown to support employment in the Arts,

TABLE 3-39. MINORITY AND POVERTY CHARACTERISTICS IN THE PLANNING AREA, 2013 ESTIMATES

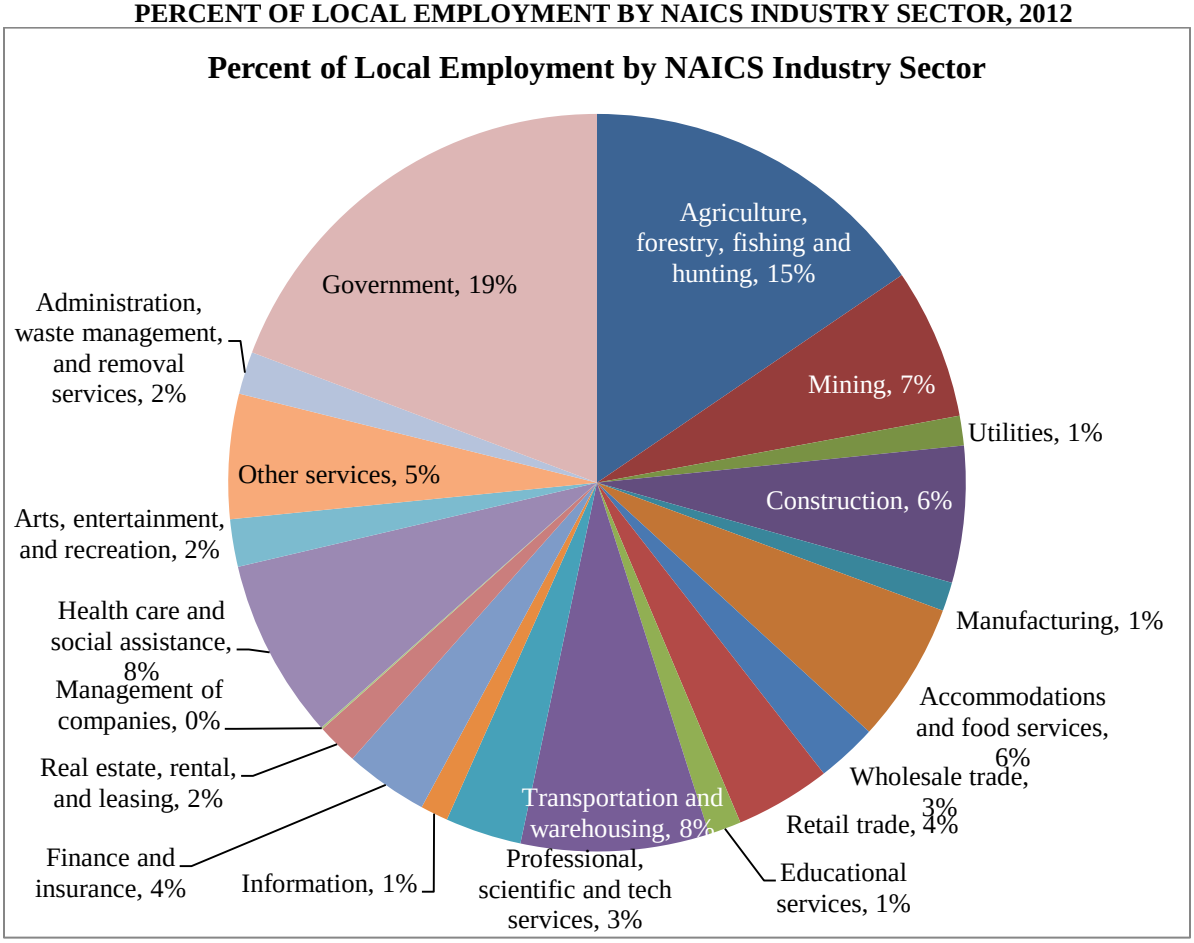
	Race Alone[1]								
County	% White	% Black or African American	% American Indian and Alaska Native	% Asian	% Native Hawaiian and Other Pacific Islander	% Two or More Races[1]	% Hispanic[1]	% Total Minority Population*	Poverty Percent, All Ages[2]
Big Horn	31.6%	0.4%	64.8%	0.5%	0.0%	2.7%	5.0%	70.3%	27.6%
Carter	98.4%	0.1%	0.9%	0.1%	0.0%	0.5%	0.8%	2.3%	15.5%
Custer	95.2%	0.5%	2.0%	0.4%	0.1%	1.7%	2.7%	6.8%	12.8%
Daniels	95.2%	0.3%	2.5%	0.3%	0.0%	1.7%	2.0%	6.4%	9.3%
Dawson	95.1%	0.4%	2.1%	0.4%	0.1%	1.9%	2.6%	7.0%	11.9%
Fallon	96.9%	0.2%	0.8%	0.7%	0.1%	1.2%	1.5%	4.4%	7.8%
Garfield	98.4%	0.2%	0.4%	0.1%	0.0%	0.9%	0.8%	2.3%	17.3%
McCone	97.2%	0.6%	0.7%	0.2%	0.1%	1.2%	1.2%	3.9%	15.5%
Powder River	95.9%	0.1%	2.0%	0.2%	0.0%	1.8%	1.7%	5.5%	12.4%
Prairie	95.2%	0.1%	0.4%	0.8%	0.0%	3.6%	2.0%	6.8%	12.7%
Richland	95.0%	0.5%	1.8%	0.4%	0.0%	2.3%	4.6%	9.1%	7.7%
Roosevelt	37.9%	0.2%	58.3%	0.4%	0.0%	3.2%	2.0%	62.8%	26.6%
Rosebud	60.4%	0.3%	35.6%	0.7%	0.0%	3.0%	4.0%	41.4%	19.5%
Sheridan	95.1%	0.4%	1.7%	0.5%	0.0%	2.2%	1.9%	6.4%	10.4%
Treasure	94.9%	0.1%	2.1%	0.3%	0.0%	2.6%	3.3%	7.4%	11.3%
Valley	87.1%	0.4%	9.6%	0.6%	0.1%	2.4%	2.1%	14.4%	13.3%
Wibaux	96.9%	0.1%	1.1%	0.4%	0.2%	1.3%	2.7%	5.6%	11.0%
Planning Area	75.0%	0.4%	21.8%	0.5%	0.0%	2.3%	3.1%	26.9%	16.1%
State of Montana	89.5%	0.6%	6.5%	0.8%	0.1%	2.5%	3.3%	13.0%	16.1%

Source:
[1]U.S. Census Bureau, Population Division, 2014d; [2]U.S. Census Bureau, Small Area Income and Poverty estimates (SAIPE) Program, 2014.
***For the purposes of this EIS, the term "total minority population" refers to the part of the total population which is not classified by the race/ethnicity category Non-Hispanic White Alone by the U.S. Census Bureau. This definition is most inclusive of populations that may be considered as a minority population under EO 12898. Calculated from U.S. Census Bureau, Population Division 2014d dat**

Entertainment & Recreation, Wholesale & Retail, Accommodation & Food Services and Transportation sectors (Marcouiller and Xia 2008). Using these industry sectors, MCFO contributed 1.6 percent of the employment and 1.5 percent of income in sectors supporting regional tourism and recreation in 2012 (IMPLAN 2012).

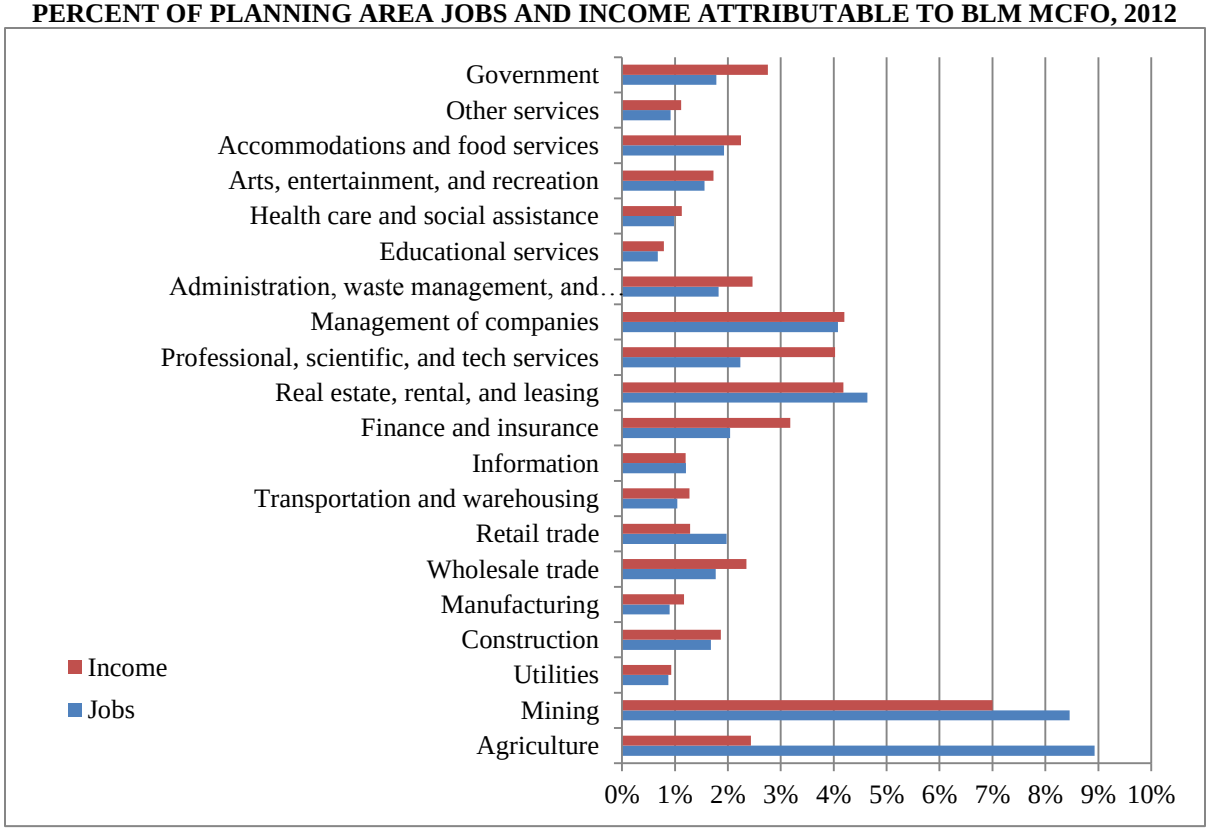
The Interior Columbia Basin Ecosystem Management Project identified communities that were specialized with respect to employment. They found that employment specialization can be examined using the ratio of the percent employment in each industry in the region of interest (17 county planning area) to the percent of employment in that industry for a larger reference region (the state of Montana). For a given industry, when the percent employment in the analysis region is greater than in the reference region, local employment specialization exists in that industry (USDA Forest Service 1998). Applying this criterion to 2012 employment data for the MCFO planning area reveals that the region can be characterized as being most specialized with respect to the Agriculture, Forestry, Fishing, and Hunting (+ 9.4%), Mining (+ 4.5%), followed by the Government and Non-NAICs sector (+ 4.2%). While changes in public land management may affect total employment in these highly specialized sectors, relatively small changes in employment are unlikely to affect specialization in the local economy.

FIGURE 3-11
PERCENT OF LOCAL EMPLOYMENT BY NAICS INDUSTRY SECTOR, 2012



Source: IMPLAN 2012

FIGURE 3-12
PERCENT OF PLANNING AREA JOBS AND INCOME ATTRIBUTABLE TO BLM MCFO, 2012



Source: IMPLAN 2012

Key Industries in the Planning Area

Agriculture, Forestry, Fishing and Hunting

Agriculture is the second largest industry in the planning area (after government) and provides 15 percent of the jobs, with most of the employment in agriculture. Agriculture has traditionally been an important industry in the planning area, and it continues to be important today. There were 6,744 farms in the planning area in 2012, totaling 25.5 million acres (NASS 2014), which accounts for 24 percent of the farms and 42 percent of the land in farms in the state.

According to the 2012 Census of Agriculture (2012), total value of farm products sold in the planning area was $4,516,008,000, which was 36 percent of the state total (NASS 2012). The average value of farm products sold per farm in 2012 across the planning area counties was $224,794. This compares to a statewide average value of farm products sold per farm of $151,031 (NASS 2012). Valley County saw the highest value of total sales with $151,464,000 in 2012 and Treasure County saw the highest sales average per farm at $427,202. Wibaux and Dawson counties saw the lowest total sales (Wibaux County at $29,270,000) and sales average per farm (Dawson County at $165,701) (NASS 2012).

Livestock production is an important part of the region's agriculture industry. While the Census of Agriculture is conducted every 5 years, livestock inventories are conducted annually on January 1st. As shown in Table 3-40,at the beginning of 2012 there were 93,800 sheep and lambs and 879,000 cattle and calves in the planning area (NASS 2012). Livestock inventories in the planning area represent 42 percent of the sheep and lambs and 35 percent of the cattle and calves in Montana.

**TABLE 3-40.
PLANNING AREA LIVESTOCK
INVENTORY, 2012**

County	Sheep and Lambs	Cattle and Calves
Big Horn	700	87,000
Carter	30,500	72,000
Custer	4,700	75,000
Daniels	N/A	19,600
Dawson	4,300	49,000
Fallon	1,900	52,000
Garfield	19,100	72,000
McCone	5,500	31,500
Powder River	12,000	81,000
Prairie	2,000	31,500
Richland	4,400	63,000
Roosevelt	1,500	37,500
Rosebud	3,400	78,000
Sheridan	1,400	24,500
Treasure	N/A	24,500
Valley	1,800	61,000
Wibaux	600	19,900
Planning Area Total	93,800	879,000
Montana Total	225,000	2,500,000

Source: USDA, NASS 2012
Notes: Data for Big Horn and Valley counties represent the entire counties, including areas of these counties that are outside of the planning area.

Many livestock operators in the area graze livestock on public lands. Forage availability and use within the planning are is variable. In 2012, there were 546,508 AUMs available for livestock use in the planning area - 524,648 cattle AUMs and 21,860 sheep AUMs.

Mineral and Energy Development

Nearly 7 percent of total employment in the 17-county study area was associated with mineral development in the Mining sector in 2012 (IMPLAN 2012). Mineral development in this region is concentrated in Big Horn, Carter, Dawson, Fallon, Powder River, Prairie, Richland, Rosebud, Treasure, Valley, and Wibaux counties and includes coal and bentonite mining, conventional oil and gas, and CBNG (BLM 2003l). To analyze impacts from conventional oil and gas and CBNG development, BLM and the State of Montana prepared a joint EIS and RMP amendment. The planning area for that EIS and RMP amendment covered the entire state, with an emphasis on BLM's Billings and Powder River Resource Management Areas. There was a high level of regional interest in CBNG production, with most concerns focused on water-related impacts. Wind power is another type of energy technology under development in the planning area.

Counties receive a share of the federal revenues from the production of federally administered minerals, the amount of which is based on the wellhead price of oil and gas and the free-on-board mine price for coal. In 2012, counties in the planning area were estimated to have received $81 million associated with all federal minerals (ONRR 2012).

Recreation and Tourism

More than three out of every four Americans participate in active outdoor recreation each year and more than

140 million Americans make outdoor recreation a priority in their daily lives (Outdoor Industry Association , 2012). Proximity to undeveloped lands and opportunities for outdoor recreation are often attributed with improving quality-of-life and contributing to the vitality of rural communities. Montana's undeveloped lands support a wide range of high quality outdoor experiences enjoyed by both local residents and out-of-state visitors. Outdoor recreationists spend money on gear, vehicles, trips, and travel-related expenses which support jobs and income, and generate tax revenues in local communities. On annual average, Montana's outdoor recreation and tourism industry is valued at more than $5.8 billion, supporting approximately 64,000 jobs and generating nearly $403 million in tax revenue (Outdoor Industry Association, 2012).

Economic activity stimulated by recreation and tourism opportunities are primarily reflected in the services and retail trade sectors. As discussed earlier, outdoor recreation and nature- based tourism supports a portion of employment in the Arts, Entertainment & Recreation, Wholesale & Retail, Accommodation & Food Services and Transportation sectors. Together, these industries account for 23 percent of the jobs in the planning area. In addition to stimulating economic activity in the recreation and tourism industry, outdoor recreation has also been generating activity in Montana's real estate industry. Individuals interested in recreational values often look for properties in proximity to public lands to increase their access to recreational opportunities. There are 14 BLM-administered recreation sites in the planning area: Moorhead Recreation Site, Howrey Island ACEC, Matthews Recreation Area, Powder River Depot SRMA, Strawberry Hill Recreation Area, Terry OHV Area, Glendive Short Pine OHV Area, Calypso Trail SRMA, Hay Draw TMA, Knowlton TMA, Lewis and Clark Trail SRMA, Pumpkin Creek Ranch and Recreation Area, Big Sky Back Country Byway, and Dean S. Reservoir. Recreation activities that do not occur at the developed sites are referred to as dispersed use. Dispersed use accounts for approximately 88 percent of the visits.

MFWP provides information on recreation in Montana and divides the state into seven regions. MFWP Region 7 includes most of the planning area, which is known for mule deer, antelope, upland game bird, and waterfowl hunting; fishing; and wildlife viewing (MFWP 2005a). The region has six state parks, four wildlife management areas, and numerous fishing access sites.

The BLM collects recreation data by recreational activity for each field office. The number of visits was documented for 33 recreational activities for fiscal year 2005 through fiscal year 2009 (The activities were categorized as General Recreation or Fish and Wildlife-related Recreation for impact analysis in Chapter 4, *Environmental Consequences*.). Fish and wildlife-related activities, principally hunting and fishing, accounted for two-thirds of the visits. General recreation (mainly camping, driving for pleasure, OHV use, and picnicking) accounted for one-third of the total visits.

Government Revenues and Contribution

A source of local government revenue directly attributable to public lands in the counties is payment in lieu of taxes. The federal government makes these payments to compensate counties for lost property tax revenue resulting from the presence of public lands (31 U.S.C. Chapter 69). There are 25.8 million acres of land in the planning area, of which 11 percent (2.8 million acres) are managed by BLM. The counties in the planning area received $3,062,745 in PILT payments in 2014 (Table 3-44). The payments are made based on population, receipt-sharing payments, and the amount of federal land in each county. Given how payments are calculated, the planning area counties do not get equal shares of the total payment since the amount of federal lands and populations across counties differ. In fiscal year 2014, a majority (63.5 percent) of the total payment to the planning area counties went to Custer and Valley counties, whereas less than 0.03 percent of the total planning area payment went to Daniels, Sheridan, and Treasure counties.

Additionally, employment in the BLM MCFO contributes directly to the planning area economy. These employees reside in the area and spend dollars at local businesses.

TABLE 3-44.
PAYMENTS IN LIEU OF TAXES FOR FISCAL YEAR 2014 , ALL FEDERAL LANDS

County	Payment ($)	Percentage of Planning Area Payment Total (%)
Big Horn	$14,903	0.5%
Carter	$203,710	6.7%
Custer	$849,852	27.7%
Daniels	$0	0.0%
Dawson	$23,005	0.8%
Fallon	$41,687	1.4%
Garfield	$219,527	7.2%
McCone	$98,586	3.2%
Powder River	$213,573	7.0%
Prairie	$154,476	5.0%
Richland	$19,496	0.6%
Roosevelt	$1,541	0.1%
Rosebud	$117,177	3.8%
Sheridan	$640	0.0%
Treasure	$269	0.0%
Valley	$1,094,603	35.7%
Wibaux	$9,709	0.3%
Planning Area Total	$3,062,754	100%

Source: U.S. Department of Interior, 2014.

Notes: Data for Big Horn and Valley counties represent the entire counties, including the areas outside of the planning area.

HAZARDOUS MATERIALS AND WASTE

Hazardous materials represent a significant risk to public safety, human health, and the environment and are therefore important issues for BLM management (Table 3-42). Hazardous materials management also involves the prevention of illegal hazardous-material actions on BLM-administered lands; the regulation, authorization, and proper use of legal hazardous materials on BLM-administered lands; and timely, safe responses to hazardous materials incidents on BLM-administered lands.

Some illicit dumping occurs on BLM-administered lands in the planning area. Much of the illicit activity is intentional, small-quantity waste dumping that may include hazardous substances, household waste, petroleum products, solid waste, and agricultural materials. Illicit dumping may occur anywhere on BLM-administered lands, but is generally concentrated around recreation areas and along roadways. These dumping incidents may not fit the specific category of hazardous waste dumping, but the dumped materials are usually screened for hazardous components before the materials are removed and disposed of properly. Instances of significant or hazardous dumping in the planning area are limited, which is attributed to the relatively low population density around the BLM-administered lands.

Hazardous materials may be brought legitimately onto BLM-administered lands for invasive species control or resource development. The types of hazardous materials used for weed and insect control include pesticides

(herbicides and insecticides). The general types of hazardous materials that may be used include petroleum products (fuels and lubricants), solvents, surfactants, paints, explosives, batteries, acids, gases, antifreeze, and mineral products (mine waste, cement, and drilling materials). Another source of hazardous materials is from actions involving ROWs, leases, and permits. Examples of these types of actions are on-site storage and use of fuels (oil and gas), telecommunication sites, and transportation facilities.

TABLE 3-42.
POTENTIAL HAZARDOUS ACTIVITIES AND EXPOSURE RISKS

Potential Hazardous Activity	Exposure Risk
Facilities on public land (under a ROW)	Leaky underground storage tanks; asbestos
Historic and active mining operations	Acid rock drainage; hazardous chemicals associated with ore processing (e.g., cyanide); explosives (e.g., dynamite, ammonium nitrate, caps, and boosters); heavy metals; asbestos
Illegal activities	Drug lab waste sites; wire burn sites
Illegal dumping of barrels or other containers containing hazardous substances	Unauthorized landfills
Military operations	Unexploded ordinance; aircraft wreckage
Oil and gas activities	Hydrogen sulfide gas; oil spills